

# **Appendix**

## **3**

### **Floodplains**

# MEMORANDUM

**TO:** Brad Rolf  
**FROM:** Linda Mark, RG and Ken Vigil, PE  
**DATE:** May 20, 2008  
**SUBJECT:** DRAFT HEC-RAS Existing Conditions Model Technical Memorandum

## INTRODUCTION

Kodiak Island Borough (KIB) does not participate in the National Flood Insurance Program (NFIP) and so does not regulate construction activities in floodplains. The State Coastal Management Plan (CMP) provides general guidelines for managing natural hazards including flooding but does not provide a strict definition of a floodplain for enforcement. Alaska Administrative Order 175 requires State agencies to use pertinent portions of the NFIP regulations as a guide for construction activities. At the Federal level Executive Order 11988, "requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative." This order requires the agencies to determine if the proposed action is in the 100-year floodplain.

FEMA floodplain mapping is not available for the Kodiak Airport area. Vigil-Agrimis, Inc. (VAI) modeled existing hydraulic conditions for the Buskin River for the 2-, 10-, and 100-year floods under both mean lower low water (MLLW) and mean higher high water (MHHW) tidal scenarios. VAI produced 10- and 100-year recurrence interval floodplain boundaries, based on model output, for use in the project base map. The existing conditions model also provided an understanding of the relationship between hydrologic processes and geomorphic conditions in the Buskin River in the vicinity of the Kodiak Airport.

The floodplain boundaries will guide the development of Runway Safety Area (RSA) improvements that, to the extent practicable, avoid or minimize impacts to the regulated floodplains. Proposed conditions modeling will be conducted later in the project when the RSA improvement alternatives have been developed in order to compare and contrast the existing conditions to various proposed conditions scenarios.

This DRAFT technical memorandum describes the existing conditions modeling and results. A FINAL technical memorandum will be written once the proposed condition modeling is completed.

## HYDROLOGY

Kodiak Island has a maritime climate (Hartman and Johnson, 1984). Weather is typically cloudy and cool with small temperature variations; strong winds; heavy precipitation; and high humidity, fog, and cloud cover. The average annual temperature is 40.5°F at the Kodiak Airport. Many microclimates exist on the island due to the mountainous terrain. Buskin River hydrology is influenced by the island's climate and precipitation.

Temperatures are typically between 20° to 40°F from November to March, and between 30° and 60°F from April to October (NOAA, 2006). Between 1973 and 2004 the highest recorded temperature at the

airport was 82°F, and the lowest recorded temperature was -16°F (ACRC, 2008). At the Kodiak Airport, average annual precipitation is 75.4 inches, with January being the wettest month and July being the driest month (NOAA, 2006). Snow is typically heavy and wet and averages 72 inches per year (ACRC, 2008).

The Buskin River is fed by several unnamed tributaries along Barometer, Erskine, and Pyramid Mountains. A key feature of this approximately 26 mi.<sup>2</sup> watershed is Buskin Lake. Buskin Lake is a feature that formed during glacial retreat in the region and is located at the center of the Buskin River Valley. The Buskin River flows about four miles southeast across the valley from the lake to an estuary at its outlet into Chiniak Bay at St. Paul Harbor. Stream systems with storage features, such as extensive wetlands, or a lake in the case of the Buskin River, tend to not have as wide a range of flows between peak events and low flow events.

Peak events are important to understand when developing public infrastructure to avoid or reduce impacts to floodplain function and the damage that can occur to natural resources or human facilities during flood events. The magnitude of flood events is typically described by the event recurrence interval. A recurrence interval is the time between events equal or greater than a given magnitude as determined statistically. The recurrence interval familiar to most people is the 100-year flood, a flood that will statistically occur once in 100 years or has a 1% chance of occurring in any given year.

Regression equations for predicting peak discharge were used to determine flows for the Buskin River in this study (Table 1). Regression equations typically use three to five parameters such as basin size, mean elevation, and rainfall to predict flows for ungaged streams based on flow information from nearby gaged streams. The regression equations used for these determinations were developed by the U.S. Geological Survey (Curran et al., 2003).

**Table 1. Buskin River Discharges Predicted Using Regression Equation**

Stream	Contributing Drainage (mi <sup>2</sup> )	Discharge (cfs)			
Recurrence Interval		Q2	Q10	Q50	Q100
Buskin River	25.7	1,700	2,870	3,990	4,480

### Tides

The Buskin River empties into St. Paul Harbor adjacent to the Kodiak Airport. Table 2 summarizes tidal elevations for this area. The water surface elevations in the Buskin River are influenced by the tidal elevations. To account for this influence in modeling the Buskin River, both low tide (MLLW) and high tide (MHHW) boundary conditions are used at the downstream end of the hydraulic model, and the model is run for all flows (2-, 10-, and 100-year) under the two different tidal conditions.

**Table 2. Tide Data for Kodiak Island, Women's Bay, Station 9457292, Epoch 1983-2001**

Tide	Elevation (feet, NAVD88)
Extreme High Water (EHW) (December 31, 1986)	14.06
Mean Higher High Water (MHHW)	9.53
Mean High Water (MHW)	8.63
Mean Tide Level (MTL)	5.25
Mean Sea Level (MSL)	5.25
Mean Low Water (MLW)	1.87
Mean Lower Low Water (MLLW)	0.76
Extreme Low Water (ELW) (January 12, 2005)	-2.43

Source: DOWL Engineers, 2008.

## MODEL BACKGROUND & METHODOLOGY

Vigil-Agrimis staff used the Hydrologic Engineering Center – River Analysis System (HEC-RAS, version 3.1.3) hydraulic software to create a planning-level existing conditions model of the Buskin River. HEC-RAS version 3.1.3 (U.S. Army Corps of Engineers, 2005) is a one-dimensional (1-D) hydraulic model developed by the U.S. Army Corps of Engineers and is one of the standard 1-D hydraulic models used in the United States. The HEC-RAS model uses site topographic information including a combination of channel cross-sections surveyed by VAI staff during September 2007 as well as survey data collected by DOWL Engineers' surveyors during autumn 2007.

## EXISTING CONDITIONS MODEL RESULTS

The Existing Conditions model was run for the 2-, 10-, and 100-year flows for both the MLLW and MHHW boundary conditions. Longitudinal profiles, existing conditions cross-sections, tabular model output for both MLLW and MHHW tidal conditions, and 10- and 100-year floodplain maps which also show the cross-section locations are located in the appendices. The analysis emphasizes existing conditions results in the Buskin River estuary and barrier bar area since this location could be affected by the proposed RSA improvements on Runway 18/36.

### 10- and 100-year Floodplains

The 10-year and 100-year floodplains were mapped for the high tide (MHHW) boundary condition (Appendix A). The 100-year floodplain boundary will be used to assess whether or not proposed modifications to the RSA extend into either of these regulated floodplains.

The 100-year floodplain encompasses the Buskin River riparian corridor and the Buskin River estuary, although the estuary is dominated more by tidal processes than fluvial processes. With the exception of the tip of the barrier bar at the mouth of the Buskin River, the top of the barrier bar is not inundated during the 100-year flow (see cross-section plots in Appendix C). With the exception of the estuary, which is broad and flat, the 100-year floodplain ranges from about 60-feet wide at RS 8358 to 470-feet wide at RS 5234 and is confined within the relatively narrow valley bottom upstream of the constriction created by the former bridge (see cross-section locations and floodplain boundary map in Appendix A). Downstream of the constriction and within the estuary, the 100-year floodplain is up to about 1,100-feet wide at RS 3755. The Airport infrastructure is outside of the 100-year floodplain.

The 10-year floodplain has a similar, albeit narrower, footprint (see cross-section locations and floodplain boundary map in Appendix A). Excluding the estuary downstream of the former bridge, the 10-year

floodplain ranges from about 60 feet wide at RS 8358 to about 400 feet wide at RS 5234. Within the estuary downstream of the constriction caused by the former bridge, the 10-year floodplain is up to about 1,100-feet wide at RS 3755. Because the estuary is backwatered during high tide, the 10- and 100-year floodplains at high tide are very similar.

### **Low Tide (MLLW) Boundary Condition**

Under low tide conditions, the river flows freely and is not backwatered by the ocean. The free-flowing nature of the river is visible in the longitudinal profiles (Appendix B), which show a decreasing water surface elevation through the estuary and in the model cross-section plots (Appendix C). Within the estuary (downstream of the constriction at RS 4496), water velocities range from 0.2 to 11.3 feet per second for the modeled flows (see tabular model output in Appendix D). Upstream of the constriction at RS 4496, velocities range from 1.3 to 11.3 feet per second for the modeled flows. The barrier bar at the mouth of the Buskin is not inundated.

### **High Tide (MHHW) Boundary Condition**

Under high tide conditions, the tide causes a backwater effect. This backwater effect is visible in the longitudinal profiles (Appendix B) and cross-section plots (Appendix C) which show a flat water surface with identical water surface elevations for all flows within the lower estuary and a nearly flat water surface with similar water surface elevations for all flows within the upper estuary. This backwater causes higher water surface elevations and slower water velocities than those under low tide conditions, particularly in the estuary downstream of the former bridge (the constriction at RS 4496). Within the estuary, velocities range from 0 to 6.5 feet per second for the modeled flows (see tabular model output in Appendix D). Upstream of the constriction at RS 4496, velocities range from 1.3 to 11.3 feet per second for the modeled flows.

## **DRAFT EXISTING CONDITIONS CONCLUSIONS**

Draft Existing Conditions modeling of the Buskin River provides a picture of current hydraulic conditions. High tide conditions, modeled using mean higher high tide for the downstream boundary condition, produce a backwater effect within the Buskin River estuary which is apparent due to the higher water surface elevations and lower velocities. Low tide conditions, modeled using mean lower low tide as the downstream boundary condition, allow the river to flow freely to the ocean. Water velocities in the estuary are higher under low tide conditions, but water surface elevations are lower. The 100-year floodplain mapping will be used to ascertain whether or not the various proposed RSA options are within the floodplain. Proposed conditions hydraulic modeling will be conducted once relevant information is available. A final hydraulic modeling report comparing existing and proposed hydraulic conditions will be completed at that time.

## REFERENCES

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- Curran, J.H., Meyer, D.F., and Tasker, G.D., 2003, Estimating the magnitude and frequency of peak streamflows for ungaged sites on streams in Alaska and conterminous basins in Canada: U.S. Geological Survey Water-Resources Investigations Report 03-4188.
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## APPENDIX A

### Cross-Section Locations and Floodplain Boundary Map



10 - AND 100-YEAR FLOODPLAIN FOR MHHW WITH CROSS SECTION LOCATIONS

0 125 250 500 1000  
SCALE 1"=500'

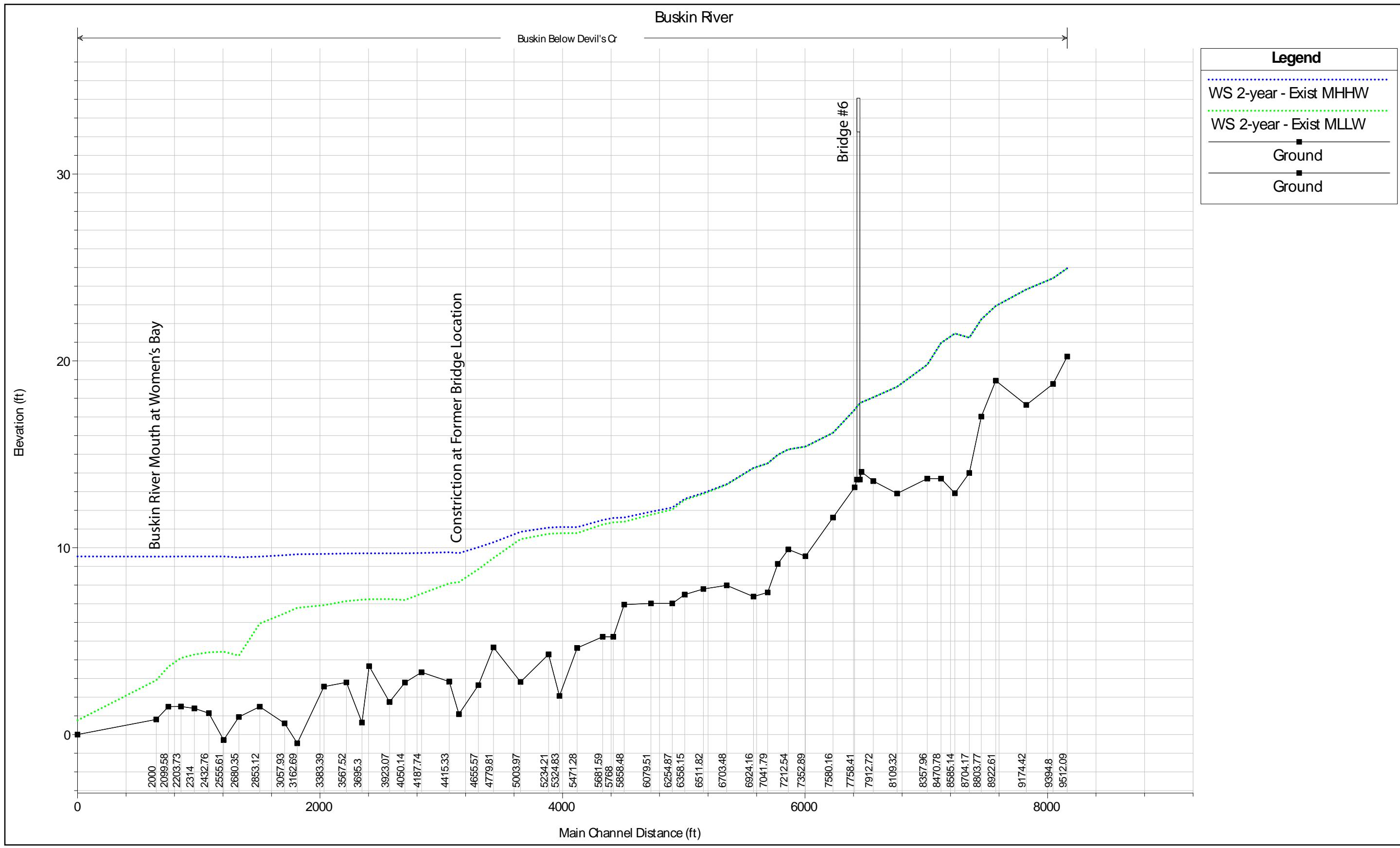


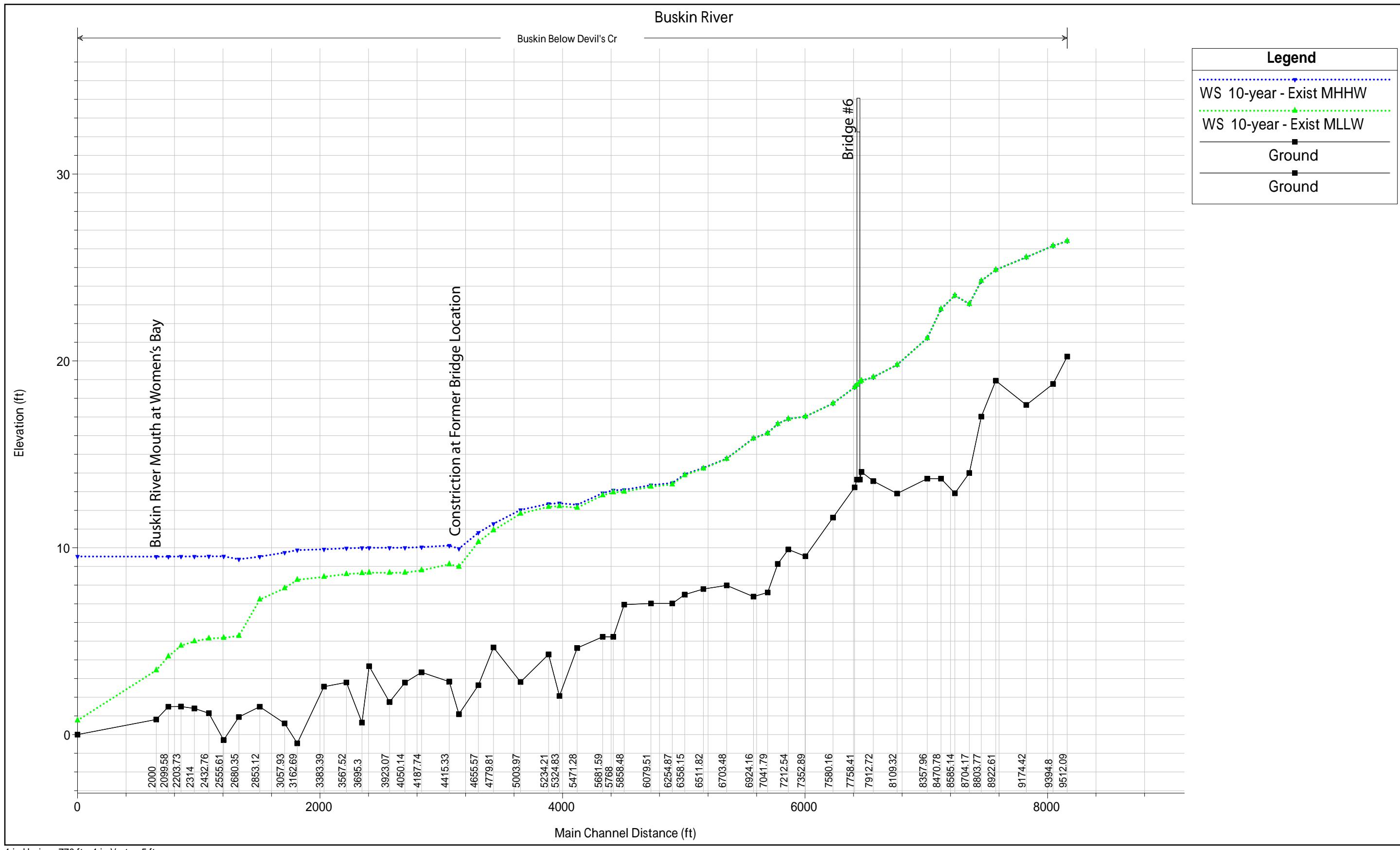
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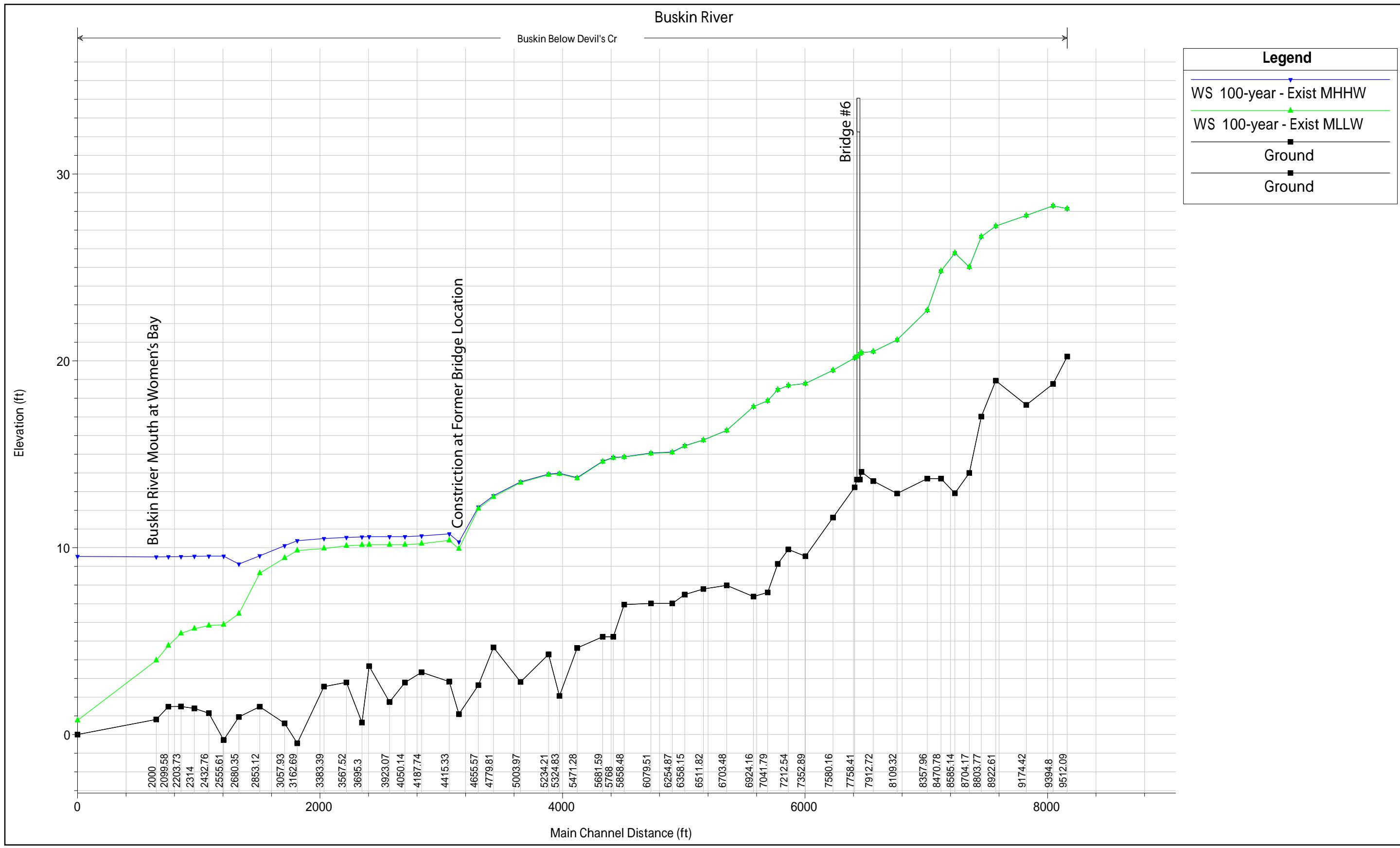
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design professionals

## APPENDIX B

### Longitudinal Profiles

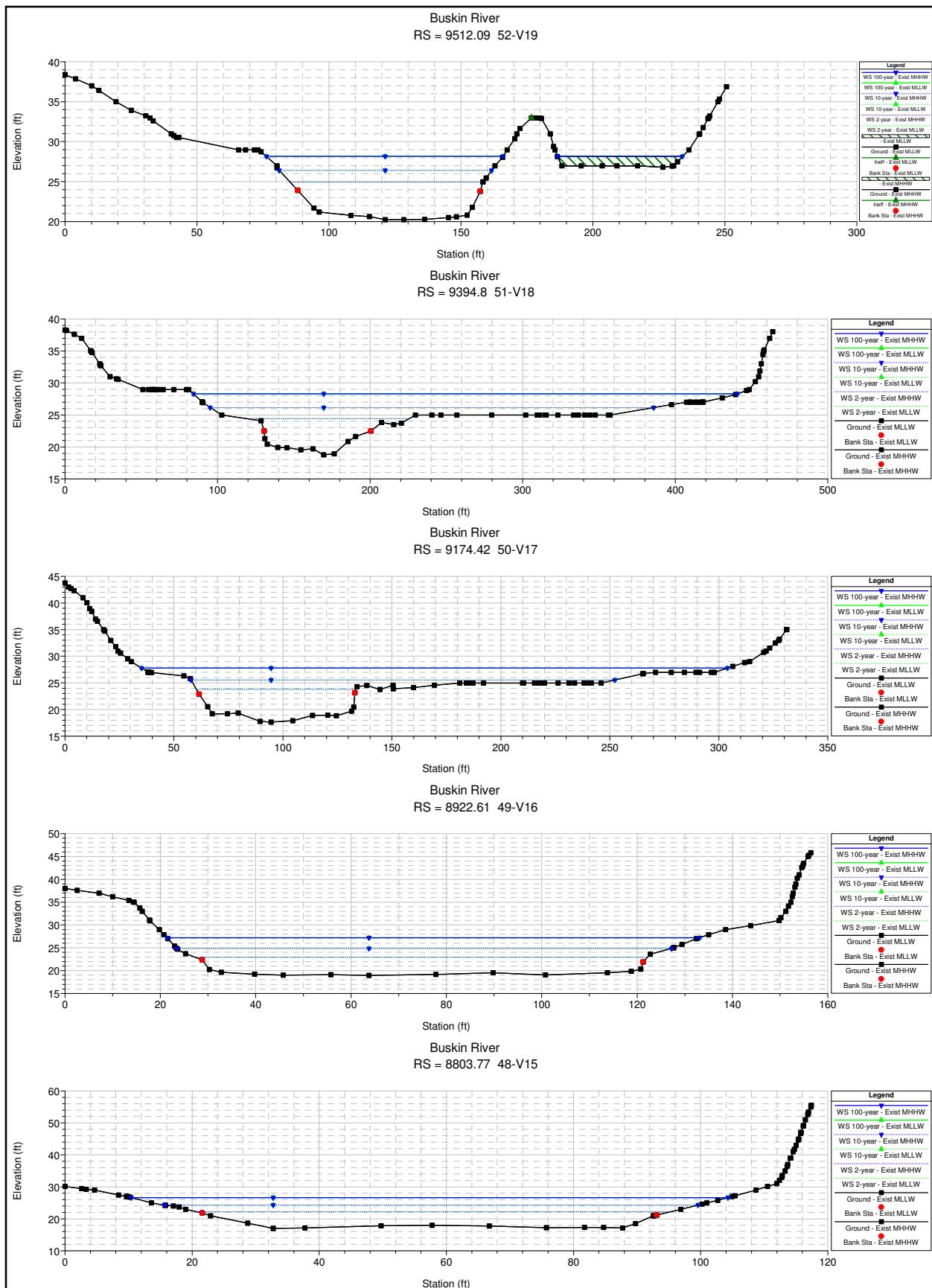


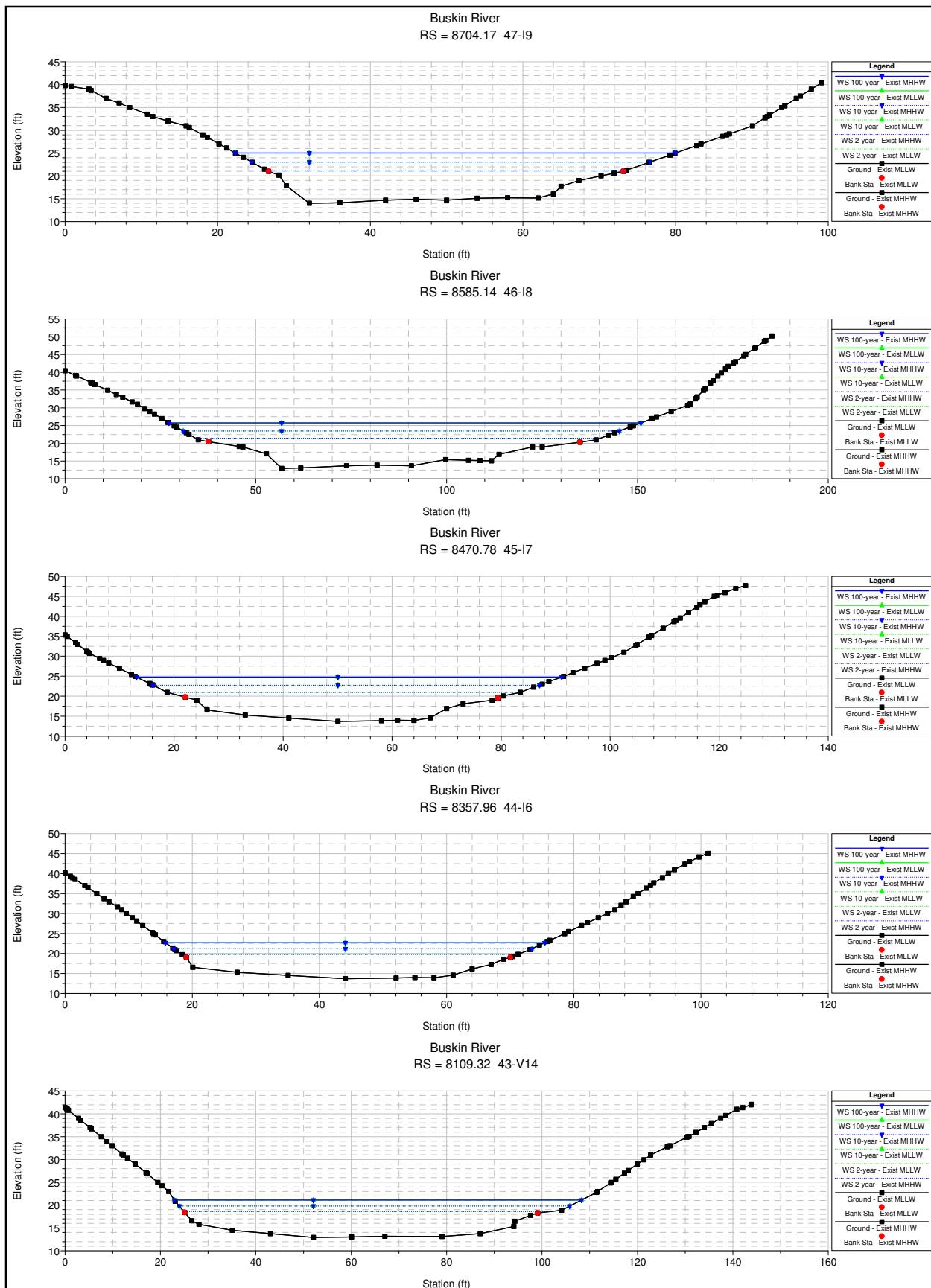


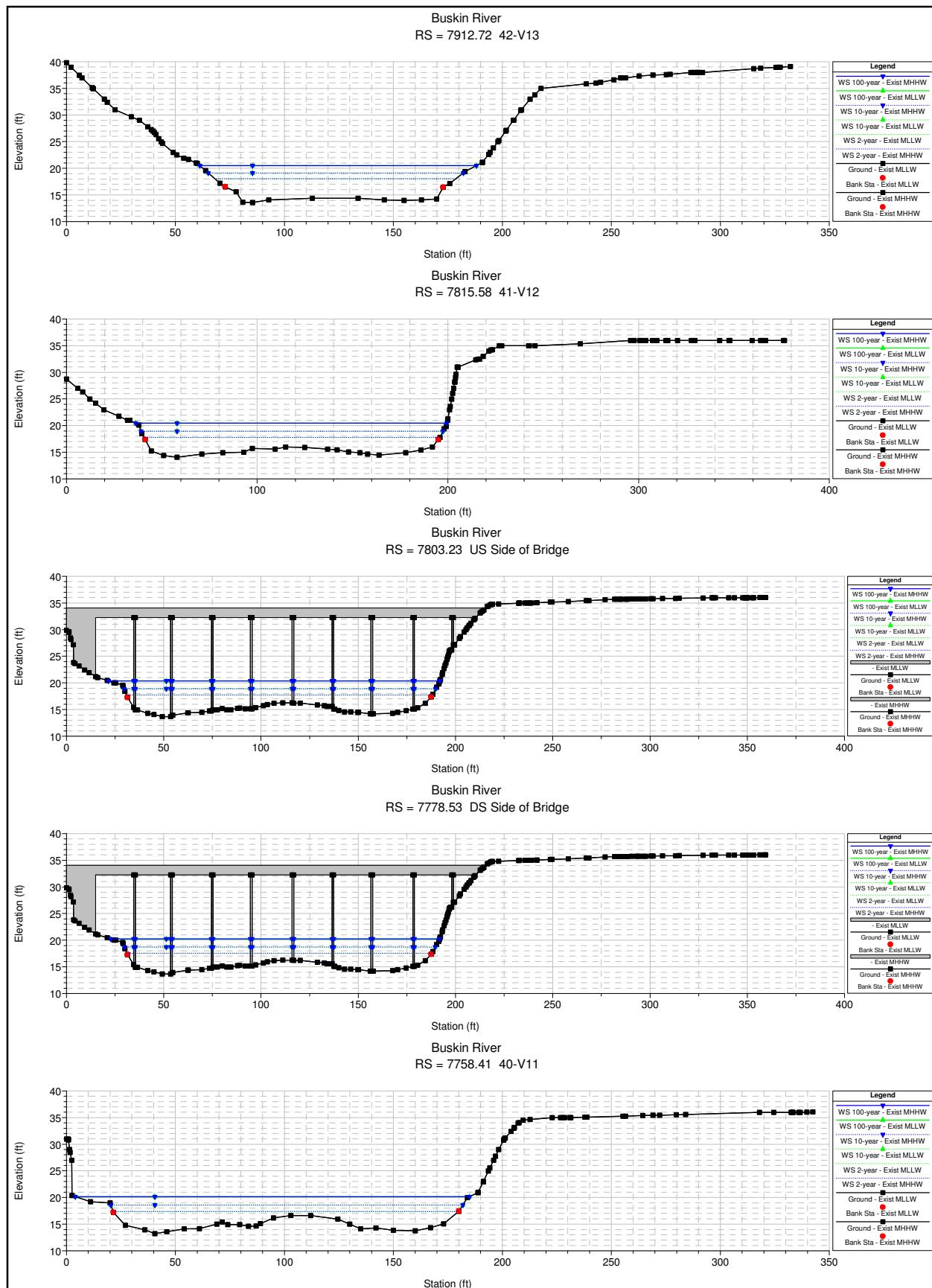


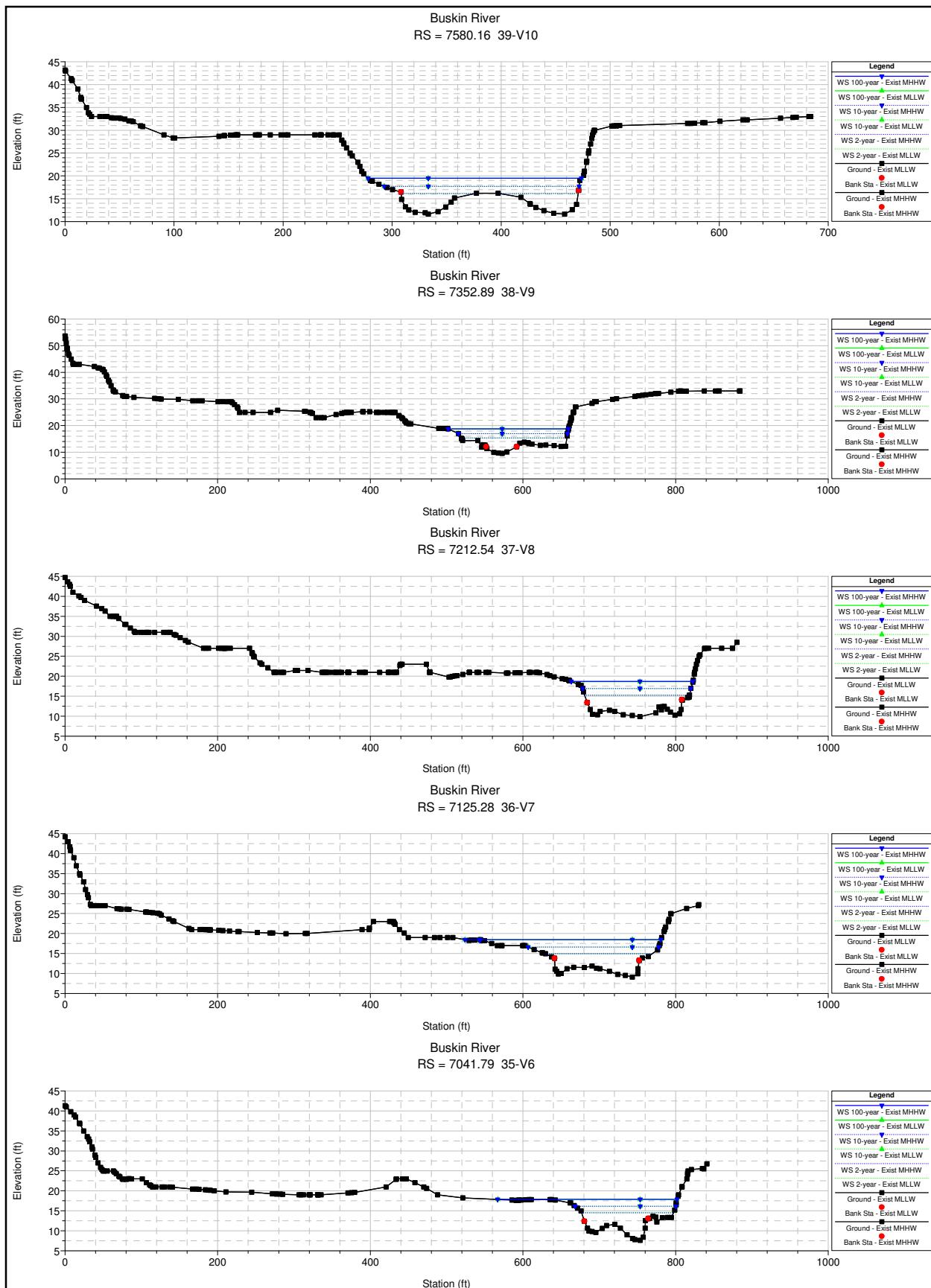
## APPENDIX C

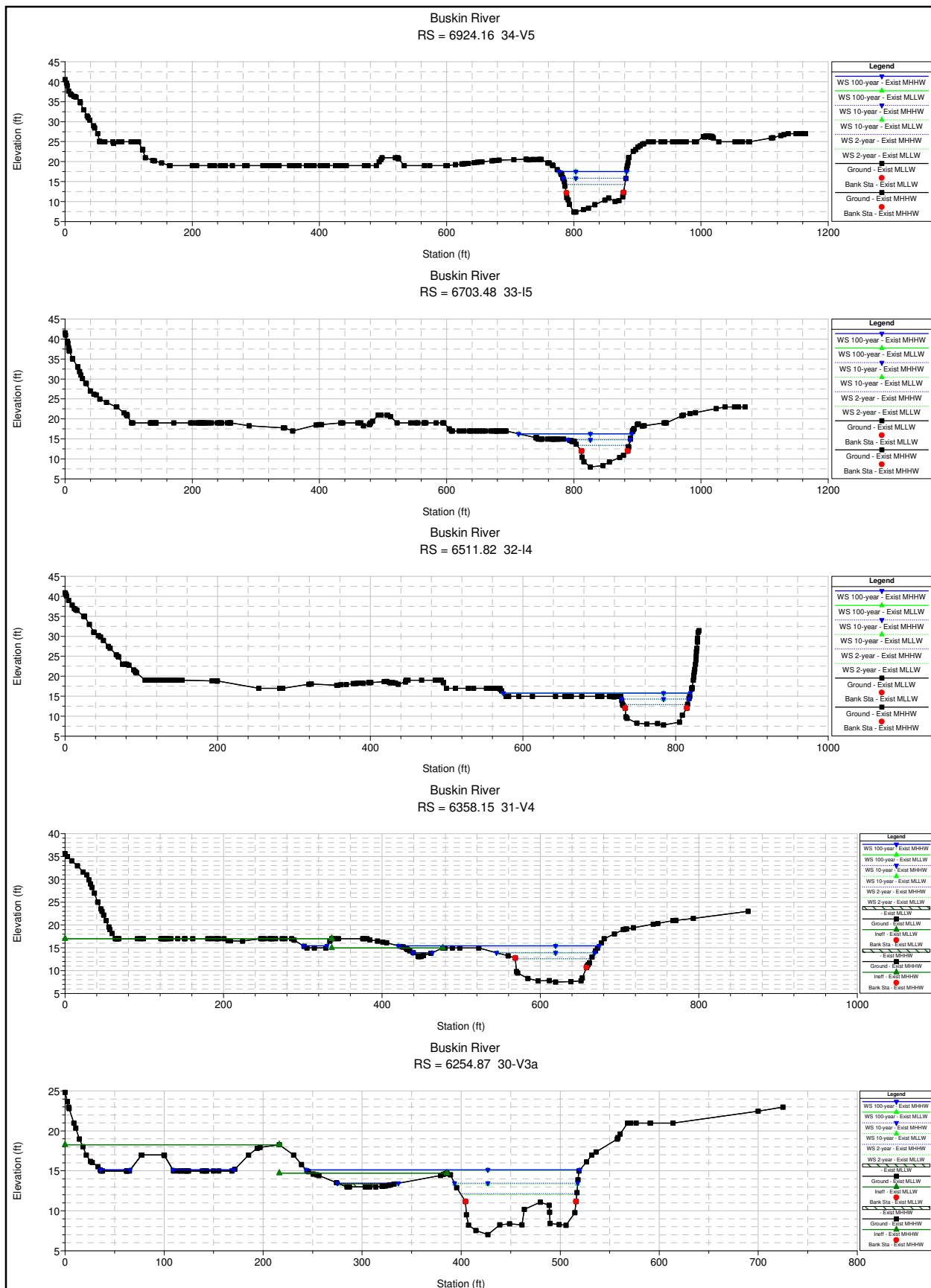
### Cross-Section Plots

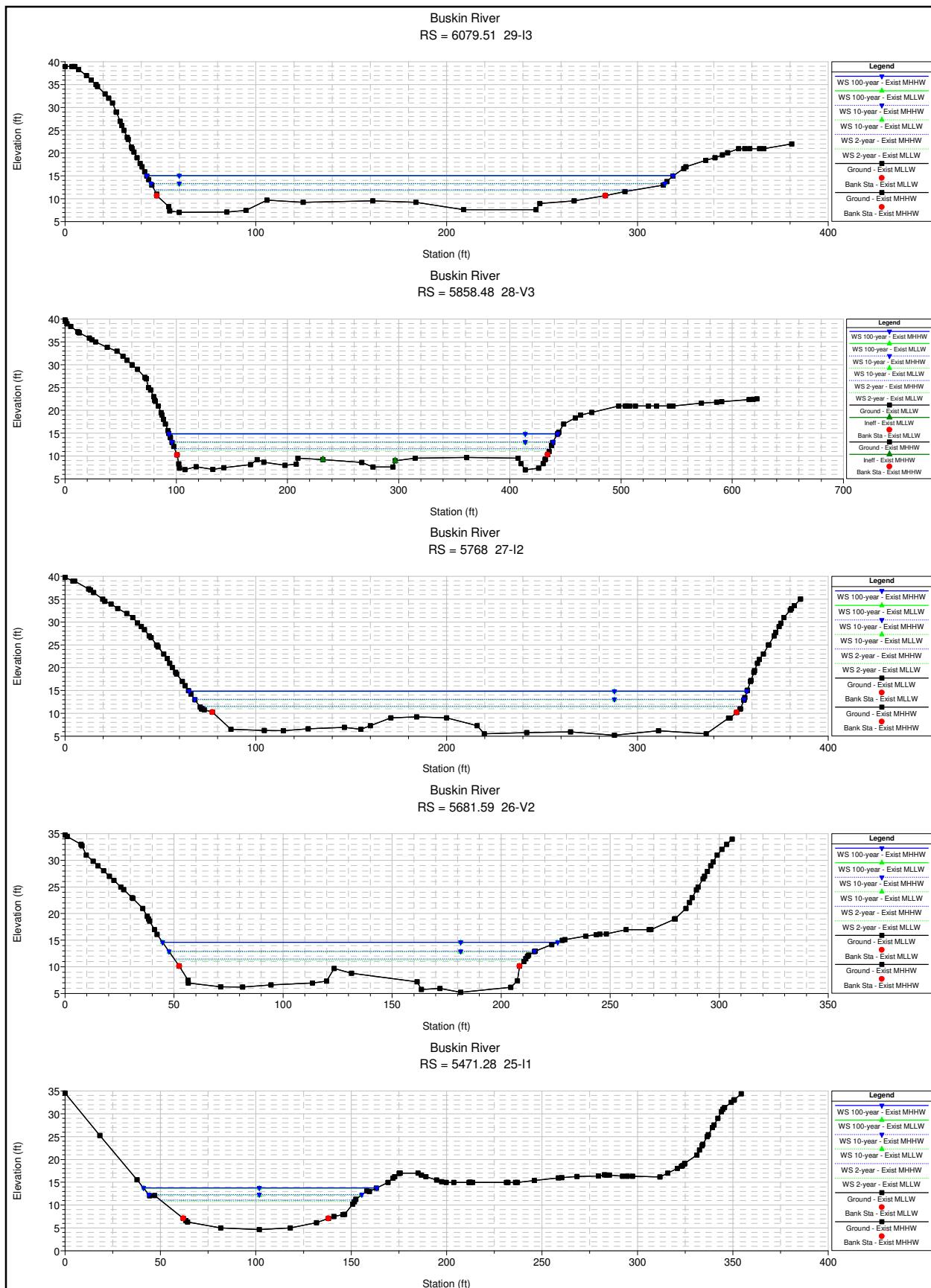


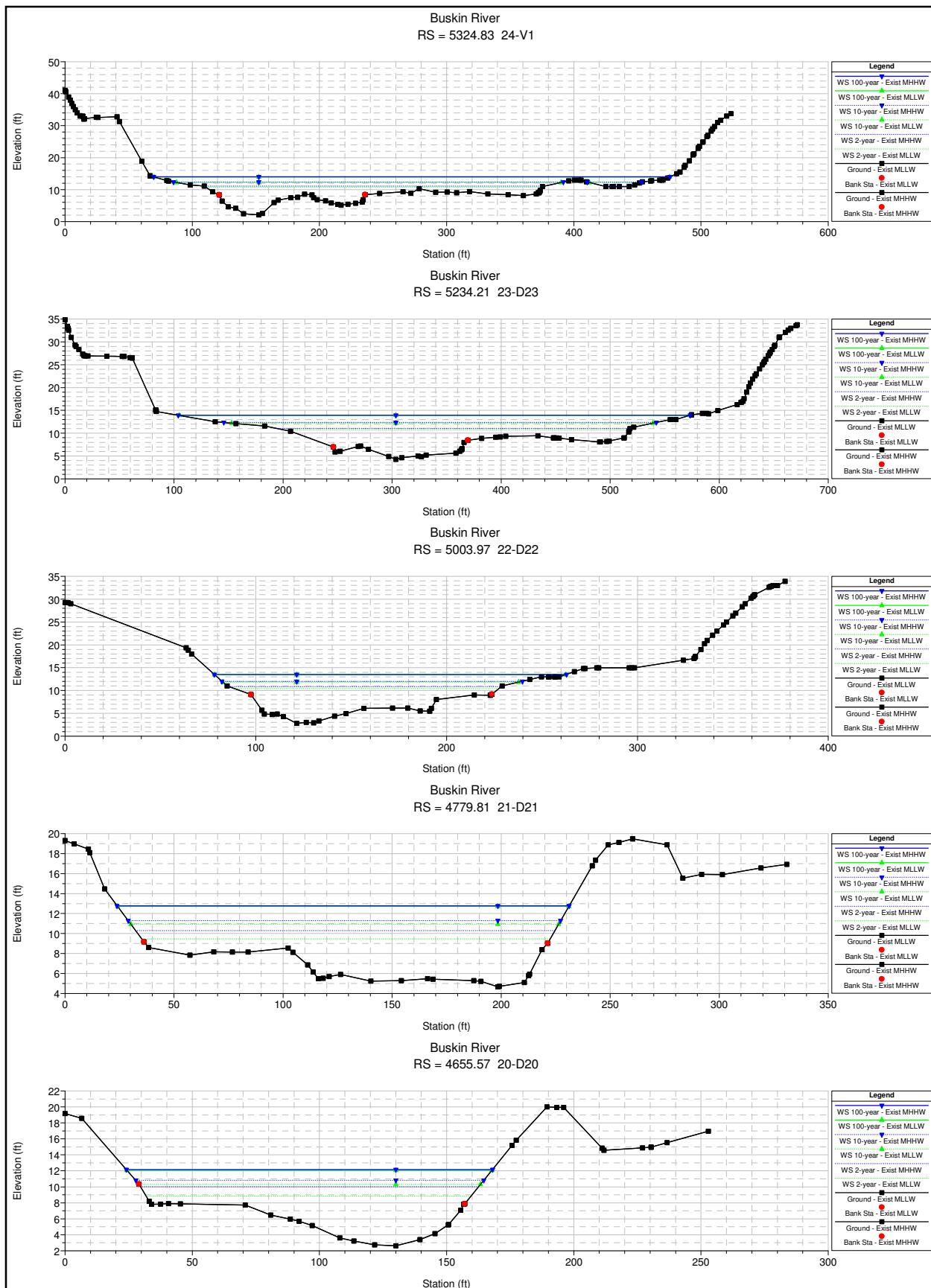


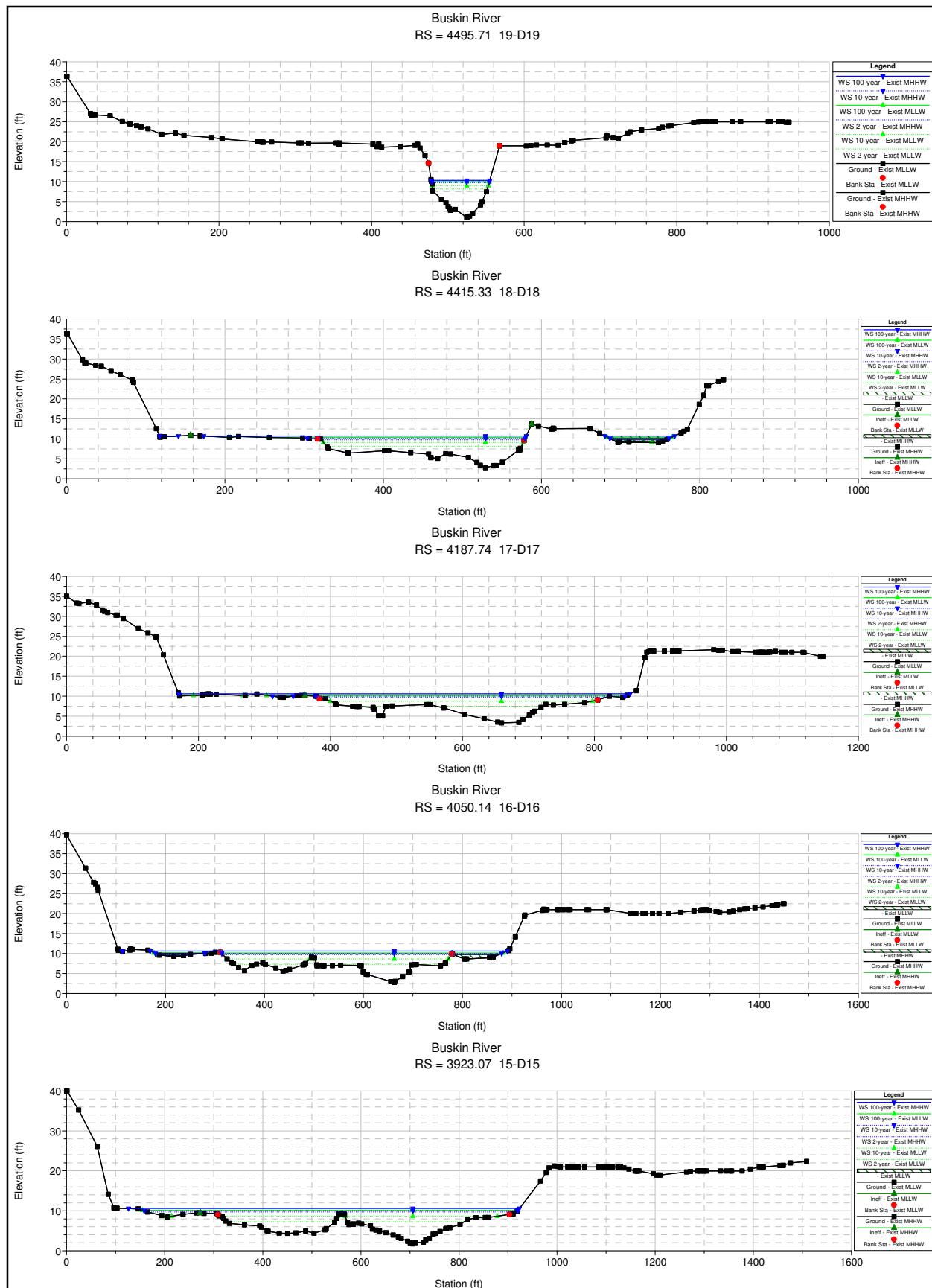


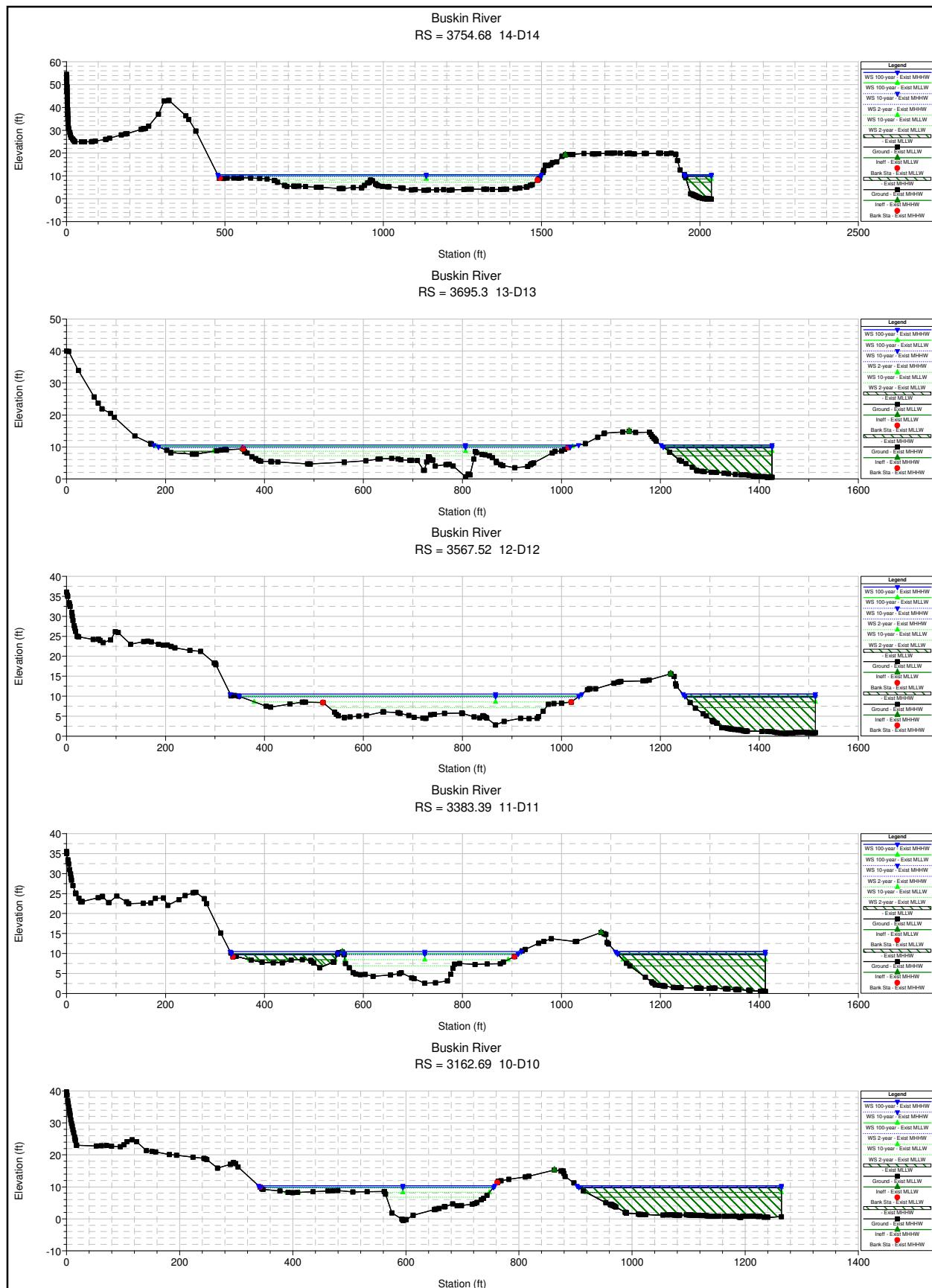


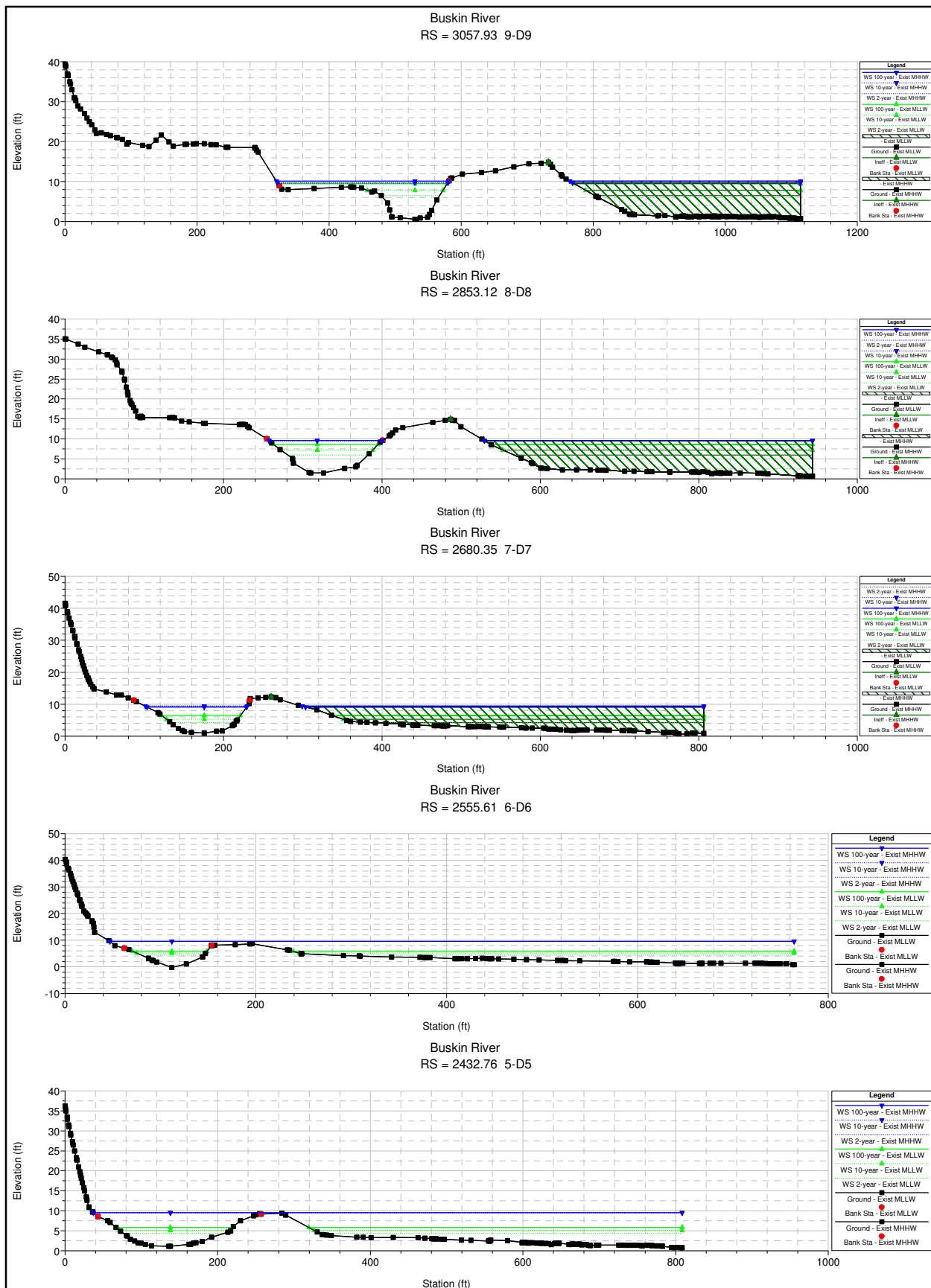


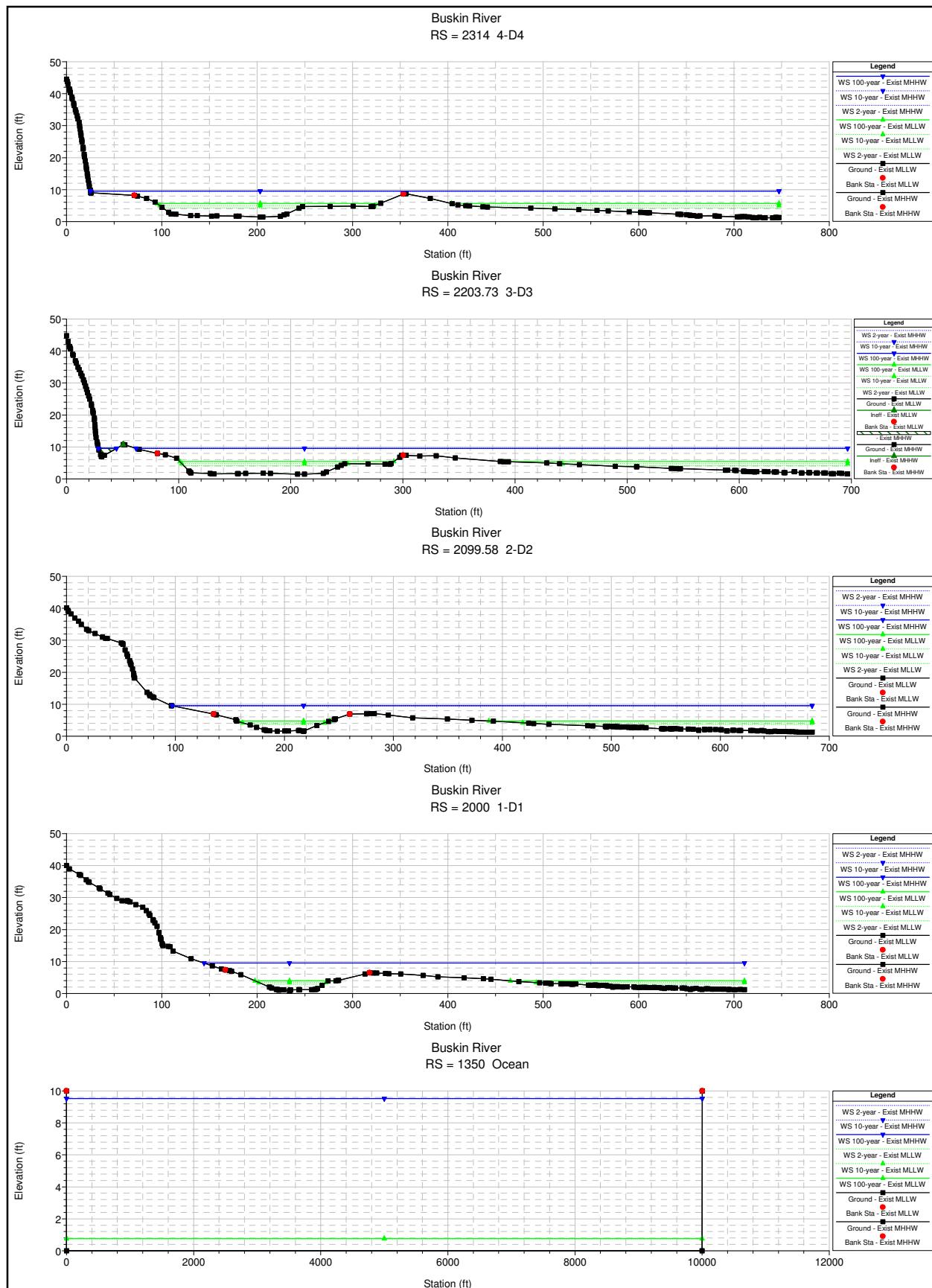












## APPENDIX D

### Tabular Draft Existing Conditions Model Output

Project: Buskin River														
Steady Flow: Buskin MLLW														
Plan: Buskin Existing MLLW														
Run as Subcritical														
Geometry: Existing Conditions														
4/1/2008														
HEC-RAS Plan: Exist MLLW														
Reach														
River: Buskin Reach: Below Devil's Cr														
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El	W.S. Elev	Hydr Radius (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Below Devil's Cr	9512.09	2-year	1700	20.2	25	3.8	23.5	25.5	0.007889	6.1	2	283	73	0.53
Below Devil's Cr	9512.09	10-year	2870	20.2	26.4	4.8	24.7	27.3	0.007991	7.5	2.7	395	81	0.56
Below Devil's Cr	9512.09	100-year	4480	20.2	28.2	5.8	26	29.3	0.007682	8.8	3.4	542	137	0.58
Below Devil's Cr	9394.8	2-year	1700	18.8	24.4	3		24.9	0.003597	5.5	0.9	325	106	0.47
Below Devil's Cr	9394.8	10-year	2870	18.8	26.2	2.4		26.6	0.002644	5.9	1	711	291	0.43
Below Devil's Cr	9394.8	100-year	4480	18.8	28.3	3.9		28.7	0.001676	5.8	0.8	1414	357	0.36
Below Devil's Cr	9174.42	2-year	1700	17.6	23.8	4.5		24.2	0.002635	4.8	0.8	355	74	0.38
Below Devil's Cr	9174.42	10-year	2870	17.6	25.6	2.9		26.1	0.00264	5.9	1	580	194	0.4
Below Devil's Cr	9174.42	100-year	4480	17.6	27.8	4		28.3	0.002007	6.2	1.1	1090	269	0.37
Below Devil's Cr	8922.61	2-year	1700	18.9	22.9	3.4		23.3	0.004342	5.1	1	336	95	0.47
Below Devil's Cr	8922.61	10-year	2870	18.9	24.9	4.9		25.4	0.002952	5.6	1	528	104	0.42
Below Devil's Cr	8922.61	100-year	4480	18.9	27.2	6.7		27.8	0.002204	6.1	1.1	780	112	0.38
Below Devil's Cr	8803.77	2-year	1700	17	22.2	4		22.7	0.006663	5.5	1.7	309	75	0.47
Below Devil's Cr	8803.77	10-year	2870	17	24.3	5.4		24.9	0.005107	6.3	2	471	84	0.44
Below Devil's Cr	8803.77	100-year	4480	17	26.6	6.9		27.4	0.004227	7	2.2	682	94	0.42
Below Devil's Cr	8704.17	2-year	1700	14	21.2	4.6		22	0.006849	7	2	244	47	0.54
Below Devil's Cr	8704.17	10-year	2870	14	23	5.6		24.2	0.007265	8.7	2.9	334	52	0.58
Below Devil's Cr	8704.17	100-year	4480	14	25	6.7		26.8	0.007682	10.6	3.9	442	58	0.62
Below Devil's Cr	8585.14	2-year	1700	12.9	21.5	4.9		21.6	0.000718	3.2	0.2	542	106	0.24
Below Devil's Cr	8585.14	10-year	2870	12.9	23.5	6.4		23.7	0.0008	3.9	0.4	765	114	0.25
Below Devil's Cr	8585.14	100-year	4480	12.9	25.8	8		26.1	0.000856	4.6	0.5	1036	124	0.26
Below Devil's Cr	8470.78	2-year	1700	13.7	21	4.7		21.4	0.006088	5.4	2	319	65	0.41
Below Devil's Cr	8470.78	10-year	2870	13.7	22.8	5.9		23.5	0.006572	6.8	2.9	442	71	0.44
Below Devil's Cr	8470.78	100-year	4480	13.7	24.8	7.1		25.8	0.006866	8.2	3.8	593	78	0.47
Below Devil's Cr	8357.96	2-year	1700	13.7	19.8	4.4		20.5	0.009431	6.9	2.7	247	53	0.55
Below Devil's Cr	8357.96	10-year	2870	13.7	21.2	5.3		22.5	0.011299	9	4.2	325	56	0.63
Below Devil's Cr	8357.96	100-year	4480	13.7	22.7	6.3		24.7	0.013435	11.3	6.1	411	60	0.71
Below Devil's Cr	8109.32	2-year	1700	12.9	18.6	4.2		19	0.003865	5	1.1	339	77	0.41
Below Devil's Cr	8109.32	10-year	2870	12.9	19.8	5.1		20.5	0.005112	6.7	1.8	433	82	0.5
Below Devil's Cr	8109.32	100-year	4480	12.9	21.1	6		22.2	0.006159	8.5	2.6	544	85	0.56
Below Devil's Cr	7912.72	2-year	1700	13.6	18.1	3.4		18.4	0.002592	4.5	0.6	384	111	0.41
Below Devil's Cr	7912.72	10-year	2870	13.6	19.1	4.2		19.7	0.003145	5.9	0.9	507	117	0.47

Project: Buskin River														
Steady Flow: Buskin MLLW														
Plan: Buskin Existing MLLW Run as Subcritical														
Geometry: Existing Conditions 4/1/2008														
HEC-RAS Plan: Exist MLLW River: Buskin Reach: Below Devil's Cr														
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Hydr Radius (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Below Devil's Cr	7912.72	100-year	4480	13.6	20.5	5.2		21.3	0.003285	7.1	1.3	673	127	0.5
Below Devil's Cr	7815.58	2-year	1700	14.1	17.8	2.6		18.1	0.003672	4.2	0.6	401	155	0.46
Below Devil's Cr	7815.58	10-year	2870	14.1	18.9	3.6		19.3	0.003055	4.9	0.7	583	158	0.45
Below Devil's Cr	7815.58	100-year	4480	14.1	20.4	4.9		20.9	0.002402	5.5	0.8	825	163	0.42
Below Devil's Cr	7803.23	2-year	1700	13.7	17.7	2.1	16.6	18	0.004905	4.2	0.6	403	151	0.45
Below Devil's Cr	7803.23	10-year	2870	13.7	18.9	2.7	17.3	19.3	0.004792	5	0.8	578	154	0.45
Below Devil's Cr	7803.23	100-year	4480	13.7	20.4	3.2	18.1	20.9	0.004473	5.6	0.9	814	164	0.43
Below Devil's Cr	7778.53	2-year	1700	13.7	17.5	2	16.6	17.9	0.00605	4.5	0.7	376	150	0.5
Below Devil's Cr	7778.53	10-year	2870	13.7	18.7	2.6	17.3	19.1	0.005468	5.2	0.9	553	153	0.48
Below Devil's Cr	7778.53	100-year	4480	13.7	20.2	3.2	18.1	20.7	0.004848	5.7	1	790	162	0.44
Below Devil's Cr	7758.41	2-year	1700	13.2	17.4	2.5		17.7	0.016168	4.3	2.5	393	159	0.48
Below Devil's Cr	7758.41	10-year	2870	13.2	18.6	3.6		19	0.01222	4.9	2.8	587	162	0.45
Below Devil's Cr	7758.41	100-year	4480	13.2	20.2	4.6		20.6	0.009046	5.3	2.9	855	181	0.41
Below Devil's Cr	7580.16	2-year	1700	11.6	16.2	2.5		16.5	0.003553	4.7	0.6	363	140	0.51
Below Devil's Cr	7580.16	10-year	2870	11.6	17.7	3.4		18.1	0.002721	4.6	0.6	629	179	0.42
Below Devil's Cr	7580.16	100-year	4480	11.6	19.5	4.8		19.9	0.002217	4.9	0.8	963	196	0.36
Below Devil's Cr	7352.89	2-year	1700	9.5	15.4	2.9		15.8	0.002768	5.6	0.8	417	138	0.45
Below Devil's Cr	7352.89	10-year	2870	9.5	17	4.3		17.5	0.002394	6.3	1	644	143	0.43
Below Devil's Cr	7352.89	100-year	4480	9.5	18.8	5.5		19.4	0.002227	7.2	1.1	908	158	0.44
Below Devil's Cr	7212.54	2-year	1700	9.9	15.3	3.9		15.4	0.001826	3.1	0.5	551	137	0.27
Below Devil's Cr	7212.54	10-year	2870	9.9	16.9	5.3		17.1	0.001768	3.8	0.6	780	142	0.28
Below Devil's Cr	7212.54	100-year	4480	9.9	18.7	6.3		19	0.001782	4.6	0.8	1045	160	0.29
Below Devil's Cr	7125.28	2-year	1700	9.1	15	3.4		15.2	0.004994	3.6	1.3	494	140	0.3
Below Devil's Cr	7125.28	10-year	2870	9.1	16.6	4.3		16.9	0.00447	4.2	1.6	755	171	0.3
Below Devil's Cr	7125.28	100-year	4480	9.1	18.5	4.4		18.8	0.003979	4.7	1.9	1149	256	0.3
Below Devil's Cr	7041.79	2-year	1700	7.6	14.5	3.4		14.8	0.00342	4.4	0.9	420	120	0.37
Below Devil's Cr	7041.79	10-year	2870	7.6	16.1	4.5		16.5	0.003286	5.3	1.2	623	132	0.38
Below Devil's Cr	7041.79	100-year	4480	7.6	17.9	3.6		18.4	0.00332	6.3	1.6	879	235	0.4
Below Devil's Cr	6924.16	2-year	1700	7.4	14.3	4.6		14.5	0.001965	3.8	0.6	447	95	0.31
Below Devil's Cr	6924.16	10-year	2870	7.4	15.9	5.8		16.2	0.002186	4.9	0.9	601	99	0.34
Below Devil's Cr	6924.16	100-year	4480	7.4	17.5	6.9		18.1	0.00245	6	1.2	773	106	0.37

Project: Buskin River														
Steady Flow: Buskin MLLW														
Plan: Buskin Existing MLLW														
Run as Subcritical														
Geometry: Existing Conditions														
4/1/2008														
HEC-RAS Plan: Exist MLLW														
River: Buskin Reach: Below Devil's Cr														
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El	W.S. Elev	Hydr Radius (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Below Devil's Cr	6703.48	2-year	1700	8	13.4	3.6		13.9	0.003724	5.7	0.9	303	81	0.5
Below Devil's Cr	6703.48	10-year	2870	8	14.8	4.2		15.5	0.003968	7.2	1.3	423	97	0.54
Below Devil's Cr	6703.48	100-year	4480	8	16.3	3.6		17.4	0.004059	8.5	1.7	651	178	0.57
Below Devil's Cr	6511.82	2-year	1700	7.8	12.9	4		13.3	0.002546	4.9	0.7	350	85	0.41
Below Devil's Cr	6511.82	10-year	2870	7.8	14.2	5.1		14.8	0.002904	6.2	1	468	88	0.46
Below Devil's Cr	6511.82	100-year	4480	7.8	15.8	2.9		16.6	0.003092	7.6	1.3	724	245	0.5
Below Devil's Cr	6358.15	2-year	1700	7.5	12.6	4.1	10.3	12.8	0.002537	4.2	0.7	406	96	0.35
Below Devil's Cr	6358.15	10-year	2870	7.5	13.9	4.4	11.3	14.3	0.003003	5.5	1.1	548	146	0.4
Below Devil's Cr	6358.15	100-year	4480	7.5	15.4	3.4	12.4	16.1	0.003105	6.5	1.4	861	283	0.43
Below Devil's Cr	6254.87	2-year	1700	7	12	3	10.5	12.4	0.009302	4.7	1.8	367	117	0.45
Below Devil's Cr	6254.87	10-year	2870	7	13.4	4.1	11.5	13.9	0.008273	5.5	2.3	530	181	0.45
Below Devil's Cr	6254.87	100-year	4480	7	15.1	3.4	12.5	15.6	0.006177	5.9	2.3	953	367	0.41
Below Devil's Cr	6079.51	2-year	1700	7	11.8	3		11.9	0.001171	2.3	0.2	752	249	0.23
Below Devil's Cr	6079.51	10-year	2870	7	13.3	4.2		13.4	0.000996	2.6	0.3	1141	269	0.21
Below Devil's Cr	6079.51	100-year	4480	7	15	5.8		15.2	0.000851	2.9	0.3	1627	276	0.2
Below Devil's Cr	5858.48	2-year	1700	7	11.4	2.7	9.4	11.4	0.003195	1.9	0.5	918	337	0.2
Below Devil's Cr	5858.48	10-year	2870	7	13	4.2	10	13.1	0.00194	2	0.5	1465	342	0.17
Below Devil's Cr	5858.48	100-year	4480	7	14.8	5.9	10.4	14.9	0.001436	2.1	0.6	2105	350	0.15
Below Devil's Cr	5768	2-year	1700	5.2	11.4	4.4		11.4	0.000203	1.3	0.1	1267	284	0.11
Below Devil's Cr	5768	10-year	2870	5.2	13	5.9		13	0.000219	1.7	0.1	1726	288	0.12
Below Devil's Cr	5768	100-year	4480	5.2	14.8	7.6		14.9	0.000228	2	0.1	2262	292	0.13
Below Devil's Cr	5681.59	2-year	1700	5.2	11.2	4.1		11.3	0.001633	2.5	0.4	681	160	0.21
Below Devil's Cr	5681.59	10-year	2870	5.2	12.8	5.4		13	0.001665	3.1	0.6	936	167	0.22
Below Devil's Cr	5681.59	100-year	4480	5.2	14.6	6.7		14.8	0.001656	3.7	0.8	1249	181	0.23
Below Devil's Cr	5471.28	2-year	1700	4.6	10.8	4.6		11	0.00123	4	0.4	468	101	0.3
Below Devil's Cr	5471.28	10-year	2870	4.6	12.1	5.4		12.6	0.00164	5.4	0.7	610	111	0.36
Below Devil's Cr	5471.28	100-year	4480	4.6	13.7	6.3		14.4	0.001956	6.8	1	792	122	0.41
Below Devil's Cr	5324.83	2-year	1700	2.1	10.8	3.2		10.9	0.000541	2.5	0.2	863	264	0.2
Below Devil's Cr	5324.83	10-year	2870	2.1	12.2	3.8		12.4	0.000577	3.1	0.2	1308	343	0.21
Below Devil's Cr	5324.83	100-year	4480	2.1	13.9	4.8		14.1	0.000537	3.5	0.3	1967	405	0.21
Below Devil's Cr	5234.21	2-year	1700	4.3	10.7	3.1		10.8	0.000502	2.4	0.2	974	317	0.19
Below Devil's Cr	5234.21	10-year	2870	4.3	12.2	3.8		12.3	0.000535	3	0.2	1472	386	0.21

Project: Buskin River														
Steady Flow: Buskin MLLW														
Plan: Buskin Existing MLLW Run as Subcritical														
Geometry: Existing Conditions 4/1/2008														
HEC-RAS Plan: Exist MLLW River: Buskin Reach: Below Devil's Cr														
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Hydr Radius (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Below Devil's Cr	5234.21	100-year	4480	4.3	13.9	4.7	14	0.000511	3.4	0.3	2216	468	0.21	
Below Devil's Cr	5003.97	2-year	1700	2.8	10.5	4.1	10.6	0.002896	3	0.8	578	139	0.25	
Below Devil's Cr	5003.97	10-year	2870	2.8	11.8	4.9	12.1	0.003346	3.8	1.2	779	155	0.28	
Below Devil's Cr	5003.97	100-year	4480	2.8	13.5	5.6	13.8	0.003455	4.6	1.6	1057	184	0.29	
Below Devil's Cr	4779.81	2-year	1700	4.7	9.4	2.8	9.6	0.00728	3.2	1.3	527	187	0.34	
Below Devil's Cr	4779.81	10-year	2870	4.7	10.9	4.1	11.1	0.005111	3.6	1.4	811	196	0.3	
Below Devil's Cr	4779.81	100-year	4480	4.7	12.7	5.6	13	0.003874	3.9	1.5	1172	207	0.28	
Below Devil's Cr	4655.57	2-year	1700	2.6	8.9	3.1	9.1	0.002354	4.2	0.5	406	128	0.41	
Below Devil's Cr	4655.57	10-year	2870	2.6	10.3	4.4	10.7	0.002597	4.9	0.7	596	134	0.4	
Below Devil's Cr	4655.57	100-year	4480	2.6	12.1	5.8	12.5	0.00255	5.5	1	844	144	0.38	
Below Devil's Cr	4495.71	2-year	1700	1.1	8.2	4.2	8.6	0.003267	5.5	0.9	309	72	0.47	
Below Devil's Cr	4495.71	10-year	2870	1.1	9	4.8	9.9	0.005371	7.8	1.6	369	73	0.61	
Below Devil's Cr	4495.71	100-year	4480	1.1	9.9	5.5	11.5	0.007668	10.2	2.7	440	76	0.74	
Below Devil's Cr	4415.33	2-year	1700	2.8	8.1	2.1	7	0.002248	3.2	0.3	529	246	0.39	
Below Devil's Cr	4415.33	10-year	2870	2.8	9.1	3.1	7.5	0.001803	3.7	0.3	783	262	0.37	
Below Devil's Cr	4415.33	100-year	4480	2.8	10.4	3.4	8.1	0.001441	4	0.4	1121	408	0.34	
Below Devil's Cr	4187.74	2-year	1700	3.3	7.5	2	6.2	0.001922	3.9	0.2	437	214	0.48	
Below Devil's Cr	4187.74	10-year	2870	3.3	8.8	2.2	7	0.001316	3.3	0.2	866	398	0.4	
Below Devil's Cr	4187.74	100-year	4480	3.3	10.2	3	8.1	0.000825	3.1	0.2	1484	571	0.29	
Below Devil's Cr	4050.14	2-year	1700	2.8	7.2	1.2	6.3	0.002828	4.1	0.2	419	355	0.66	
Below Devil's Cr	4050.14	10-year	2870	2.8	8.7	2.3	7.3	0.001083	2.8	0.2	1024	444	0.32	
Below Devil's Cr	4050.14	100-year	4480	2.8	10.2	3.2	7.8	0.000609	2.6	0.1	1816	689	0.24	
Below Devil's Cr	3923.07	2-year	1700	1.7	7.2	2.2	5.1	0.000347	1.7	0	1012	458	0.2	
Below Devil's Cr	3923.07	10-year	2870	1.7	8.7	3.1	5.6	0.000239	1.7	0	1705	563	0.17	
Below Devil's Cr	3923.07	100-year	4480	1.7	10.2	3.6	6.2	0.00018	1.7	0	2736	766	0.14	
Below Devil's Cr	3754.68	2-year	1700	3.7	7.2	2.5	5	0.000093	0.8	0	2005	875	0.09	
Below Devil's Cr	3754.68	10-year	2870	3.7	8.7	3.7	5.3	0.000064	0.9	0	3178	938	0.08	
Below Devil's Cr	3754.68	100-year	4480	3.7	10.2	4.6	5.6	0.000053	1	0	4644	1103	0.08	
Below Devil's Cr	3695.3	2-year	1700	0.6	7.2	2.2	5.2	0.000279	1.4	0	1255	766	0.16	
Below Devil's Cr	3695.3	10-year	2870	0.6	8.6	3.3	5.7	0.00017	1.4	0	2113	929	0.13	
Below Devil's Cr	3695.3	100-year	4480	0.6	10.1	4	6.1	0.000121	1.4	0	3356	1060	0.11	

Project: Buskin River														
Plan: Buskin Existing MLLW			Steady Flow: Buskin MLLW											
			Run as Subcritical											
Geometry: Existing Conditions												4/1/2008		
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El	W.S. Elev	Hydr Radius (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Below Devil's Cr	3567.52	2-year	1700	2.8	7.1	2.1	5.7	7.2	0.000589	1.9	0.1	914	681	0.23
Below Devil's Cr	3567.52	10-year	2870	2.8	8.6	2.6	6.1	8.6	0.000288	1.8	0.1	1651	896	0.18
Below Devil's Cr	3567.52	100-year	4480	2.8	10.1	3.8	6.5	10.1	0.00019	1.8	0.1	2656	959	0.15
Below Devil's Cr	3383.39	2-year	1700	2.6	6.9	2.8	5.3	7	0.000959	2.9	0.2	594	504	0.3
Below Devil's Cr	3383.39	10-year	2870	2.6	8.4	3.1	5.9	8.6	0.000602	2.8	0.1	1033	788	0.28
Below Devil's Cr	3383.39	100-year	4480	2.6	10	4.4	6.5	10.1	0.000471	2.9	0.1	1553	868	0.24
Below Devil's Cr	3162.69	2-year	1700	-0.5	6.8	3.7	3.8	6.9	0.000525	2.6	0.1	654	503	0.24
Below Devil's Cr	3162.69	10-year	2870	-0.5	8.3	4.5	4.9	8.4	0.000506	3.1	0.1	925	550	0.26
Below Devil's Cr	3162.69	100-year	4480	-0.5	9.8	3.6	5.7	10	0.000458	3	0.1	1493	770	0.28
Below Devil's Cr	3057.93	2-year	1700	0.6	6.5	4.3	3.9	6.8	0.001315	4.4	0.3	384	400	0.37
Below Devil's Cr	3057.93	10-year	2870	0.6	7.8	4.4	5.1	8.3	0.001742	5.5	0.5	518	440	0.46
Below Devil's Cr	3057.93	100-year	4480	0.6	9.5	3.3	6.4	9.9	0.001548	5.2	0.3	856	599	0.5
Below Devil's Cr	2853.12	2-year	1700	1.5	5.9	3.1	4.7	6.4	0.002933	5.4	0.6	317	477	0.53
Below Devil's Cr	2853.12	10-year	2870	1.5	7.2	3.9	5.7	7.8	0.002999	6.3	0.7	456	507	0.56
Below Devil's Cr	2853.12	100-year	4480	1.5	8.6	4.7	6.8	9.4	0.002949	7.1	0.9	631	538	0.57
Below Devil's Cr	2680.35	2-year	1700	0.9	4.2	2.4	4.2	5.4	0.011266	8.8	1.7	194	501	1
Below Devil's Cr	2680.35	10-year	2870	0.9	5.3	3.1	5.3	6.9	0.010319	10.1	2	284	545	1
Below Devil's Cr	2680.35	100-year	4480	0.9	6.5	3.9	6.5	8.5	0.009543	11.3	2.3	396	568	1
Below Devil's Cr	2555.61	2-year	1700	-0.3	4.4	2			0.000321	1.6	0.1	1123	552	0.17
Below Devil's Cr	2555.61	10-year	2870	-0.3	5.2	2.6			0.000334	1.8	0.1	1548	591	0.18
Below Devil's Cr	2555.61	100-year	4480	-0.3	5.9	3.2			0.000385	2.1	0.1	1965	603	0.2
Below Devil's Cr	2432.76	2-year	1700	1.1	4.4	2.1			0.000262	1.3	0	1261	608	0.15
Below Devil's Cr	2432.76	10-year	2870	1.1	5.1	2.7			0.000276	1.5	0	1718	629	0.16
Below Devil's Cr	2432.76	100-year	4480	1.1	5.8	3.3			0.000321	1.8	0.1	2158	642	0.18
Below Devil's Cr	2314	2-year	1700	1.4	4.3	1.8			0.000882	2.4	0.1	752	404	0.28
Below Devil's Cr	2314	10-year	2870	1.4	5	2			0.001117	2.4	0.1	1090	553	0.31
Below Devil's Cr	2314	100-year	4480	1.4	5.7	2.5			0.001061	2.8	0.2	1472	577	0.31
Below Devil's Cr	2203.73	2-year	1700	1.5	4.1	1.7	3.1	4.2	0.001534	3.1	0.2	602	354	0.37
Below Devil's Cr	2203.73	10-year	2870	1.5	4.8	1.9	3.6	4.9	0.001868	3.4	0.3	855	438	0.4
Below Devil's Cr	2203.73	100-year	4480	1.5	5.4	2.3	4.1	5.6	0.001929	4	0.3	1160	498	0.43
Below Devil's Cr	2099.58	2-year	1700	1.5	3.6	1.3			0.004426	4	0.4	407	298	0.58
Below Devil's Cr	2099.58	10-year	2870	1.5	4.2	1.7			0.004415	4.6	0.5	584	340	0.6

Project: Buskin River		Steady Flow: Buskin MLLW												
Plan: Buskin Existing MLLW		Run as Subcritical												
Geometry: Existing Conditions		4/1/2008												
HEC-RAS Plan: Exist MLLW		River: Buskin Reach: Below Devil's Cr												
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El	W.S. Elev	Hydr Radius (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Below Devil's Cr	2099.58	100-year	4480	1.5	4.8	2	5.3	0.004238	5	0.6	791	382	0.6	
Below Devil's Cr	2000	2-year	1700	0.8	2.9	1.2	2.9	3.5	0.011757	6.4	1.1	278	237	0.94
Below Devil's Cr	2000	10-year	2870	0.8	3.4	1.4	3.4	4.2	0.010845	7.2	1.2	421	289	0.94
Below Devil's Cr	2000	100-year	4480	0.8	4	1.7	4	4.9	0.010389	7.4	1.3	583	330	0.93
Below Devil's Cr	1350	2-year	1700	0	0.8	0.8	0.1	0.8	0.000026	0.2	0	7599	9999	0.05
Below Devil's Cr	1350	10-year	2870	0	0.8	0.8	0.1	0.8	0.000073	0.4	0	7599	9999	0.08
Below Devil's Cr	1350	100-year	4480	0	0.8	0.8	0.2	0.8	0.000178	0.6	0	7599	9999	0.12

Project: Buskin River		Steady Flow: Buskin MHHW												
Plan: Buskin Existing MHHW		Run as Subcritical												
Geometry: Existing Conditions		4/1/2008												
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Hydr Radius (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Below Devil's Cr	9512.09	2-year	1700	20.2	25	3.8	23.5	25.5	0.007889	6.1	2	283	73	0.53
Below Devil's Cr	9512.09	10-year	2870	20.2	26.4	4.8	24.7	27.3	0.007991	7.5	2.7	395	81	0.56
Below Devil's Cr	9512.09	100-year	4480	20.2	28.2	5.8	26	29.3	0.007682	8.8	3.4	542	137	0.58
Below Devil's Cr	9394.8	2-year	1700	18.8	24.4	3		24.9	0.003597	5.5	0.9	325	106	0.47
Below Devil's Cr	9394.8	10-year	2870	18.8	26.2	2.4		26.6	0.002644	5.9	1	711	291	0.43
Below Devil's Cr	9394.8	100-year	4480	18.8	28.3	3.9		28.7	0.001676	5.8	0.8	1414	357	0.36
Below Devil's Cr	9174.42	2-year	1700	17.6	23.8	4.5		24.2	0.002635	4.8	0.8	355	74	0.38
Below Devil's Cr	9174.42	10-year	2870	17.6	25.6	2.9		26.1	0.00264	5.9	1	580	194	0.4
Below Devil's Cr	9174.42	100-year	4480	17.6	27.8	4		28.3	0.002007	6.2	1.1	1090	269	0.37
Below Devil's Cr	8922.61	2-year	1700	18.9	22.9	3.4		23.3	0.004342	5.1	1	336	95	0.47
Below Devil's Cr	8922.61	10-year	2870	18.9	24.9	4.9		25.4	0.002952	5.6	1	528	104	0.42
Below Devil's Cr	8922.61	100-year	4480	18.9	27.2	6.7		27.8	0.002204	6.1	1.1	780	112	0.38
Below Devil's Cr	8803.77	2-year	1700	17	22.2	4		22.7	0.006663	5.5	1.7	309	75	0.47
Below Devil's Cr	8803.77	10-year	2870	17	24.3	5.4		24.9	0.005107	6.3	2	471	84	0.44
Below Devil's Cr	8803.77	100-year	4480	17	26.6	6.9		27.4	0.004227	7	2.2	682	94	0.42
Below Devil's Cr	8704.17	2-year	1700	14	21.2	4.6		22	0.006849	7	2	244	47	0.54
Below Devil's Cr	8704.17	10-year	2870	14	23	5.6		24.2	0.007265	8.7	2.9	334	52	0.58
Below Devil's Cr	8704.17	100-year	4480	14	25	6.7		26.8	0.007682	10.6	3.9	442	58	0.62
Below Devil's Cr	8585.14	2-year	1700	12.9	21.5	4.9		21.6	0.000718	3.2	0.2	542	106	0.24
Below Devil's Cr	8585.14	10-year	2870	12.9	23.5	6.4		23.7	0.0008	3.9	0.4	765	114	0.25
Below Devil's Cr	8585.14	100-year	4480	12.9	25.8	8		26.1	0.000856	4.6	0.5	1036	124	0.26
Below Devil's Cr	8470.78	2-year	1700	13.7	21	4.7		21.4	0.006088	5.4	2	319	65	0.41
Below Devil's Cr	8470.78	10-year	2870	13.7	22.8	5.9		23.5	0.006572	6.8	2.9	442	71	0.44
Below Devil's Cr	8470.78	100-year	4480	13.7	24.8	7.1		25.8	0.006866	8.2	3.8	593	78	0.47
Below Devil's Cr	8357.96	2-year	1700	13.7	19.8	4.4		20.5	0.009431	6.9	2.7	247	53	0.55
Below Devil's Cr	8357.96	10-year	2870	13.7	21.2	5.3		22.5	0.011298	9	4.2	325	56	0.63
Below Devil's Cr	8357.96	100-year	4480	13.7	22.7	6.3		24.7	0.013435	11.3	6.1	411	60	0.71
Below Devil's Cr	8109.32	2-year	1700	12.9	18.6	4.2		19	0.003866	5	1.1	339	77	0.41
Below Devil's Cr	8109.32	10-year	2870	12.9	19.8	5.1		20.5	0.005111	6.7	1.8	433	82	0.49
Below Devil's Cr	8109.32	100-year	4480	12.9	21.1	6		22.2	0.006159	8.5	2.6	544	85	0.56
Below Devil's Cr	7912.72	2-year	1700	13.6	18.1	3.4		18.4	0.002592	4.5	0.6	384	111	0.41
Below Devil's Cr	7912.72	10-year	2870	13.6	19.1	4.2		19.7	0.003144	5.9	0.9	507	117	0.47
Below Devil's Cr	7912.72	100-year	4480	13.6	20.5	5.2		21.3	0.003284	7.1	1.3	673	127	0.5

Project: Buskin River														
Steady Flow: Buskin MHHW														
Plan: Buskin Existing MHHW Run as Subcritical														
Geometry: Existing Conditions 4/1/2008														
HEC-RAS Plan: Exist MHHW River: Buskin Reach: Below Devil's Cr														
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Hydr Radius (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Below Devil's Cr	7815.58	2-year	1700	14.1	17.8	2.6		18.1	0.003672	4.2	0.6	401	155	0.46
Below Devil's Cr	7815.58	10-year	2870	14.1	18.9	3.6		19.3	0.003053	4.9	0.7	583	158	0.45
Below Devil's Cr	7815.58	100-year	4480	14.1	20.4	4.9		20.9	0.002401	5.5	0.8	825	163	0.42
Below Devil's Cr	7803.23	2-year	1700	13.7	17.7	2.1	16.6	18	0.004905	4.2	0.6	403	151	0.45
Below Devil's Cr	7803.23	10-year	2870	13.7	18.9	2.7	17.3	19.3	0.004789	5	0.8	579	154	0.45
Below Devil's Cr	7803.23	100-year	4480	13.7	20.4	3.2	18.1	20.9	0.004472	5.6	0.9	814	164	0.43
Below Devil's Cr	7778.53	2-year	1700	13.7	17.5	2	16.6	17.9	0.00605	4.5	0.7	376	150	0.5
Below Devil's Cr	7778.53	10-year	2870	13.7	18.7	2.6	17.3	19.1	0.005464	5.2	0.9	553	153	0.48
Below Devil's Cr	7778.53	100-year	4480	13.7	20.2	3.2	18.1	20.7	0.004846	5.7	1	790	162	0.44
Below Devil's Cr	7758.41	2-year	1700	13.2	17.4	2.5		17.7	0.016169	4.3	2.5	393	159	0.48
Below Devil's Cr	7758.41	10-year	2870	13.2	18.6	3.6		19	0.012206	4.9	2.8	587	162	0.45
Below Devil's Cr	7758.41	100-year	4480	13.2	20.2	4.6		20.6	0.009042	5.3	2.9	855	181	0.41
Below Devil's Cr	7580.16	2-year	1700	11.6	16.2	2.5		16.5	0.003546	4.7	0.6	363	140	0.51
Below Devil's Cr	7580.16	10-year	2870	11.6	17.7	3.4		18.1	0.002714	4.6	0.6	630	179	0.42
Below Devil's Cr	7580.16	100-year	4480	11.6	19.5	4.8		19.9	0.002216	4.9	0.8	963	196	0.36
Below Devil's Cr	7352.89	2-year	1700	9.5	15.4	2.9		15.8	0.002756	5.6	0.8	418	138	0.45
Below Devil's Cr	7352.89	10-year	2870	9.5	17	4.3		17.5	0.002385	6.3	1	644	143	0.43
Below Devil's Cr	7352.89	100-year	4480	9.5	18.8	5.5		19.4	0.002226	7.2	1.1	909	158	0.44
Below Devil's Cr	7212.54	2-year	1700	9.9	15.3	3.9		15.4	0.001817	3.1	0.5	552	137	0.26
Below Devil's Cr	7212.54	10-year	2870	9.9	16.9	5.3		17.1	0.001761	3.8	0.6	781	142	0.27
Below Devil's Cr	7212.54	100-year	4480	9.9	18.7	6.3		19	0.00178	4.6	0.8	1046	160	0.29
Below Devil's Cr	7125.28	2-year	1700	9.1	15	3.4		15.2	0.004964	3.6	1.3	495	140	0.3
Below Devil's Cr	7125.28	10-year	2870	9.1	16.6	4.3		16.9	0.00445	4.2	1.6	756	171	0.3
Below Devil's Cr	7125.28	100-year	4480	9.1	18.5	4.4		18.8	0.003975	4.7	1.9	1150	256	0.3
Below Devil's Cr	7041.79	2-year	1700	7.6	14.5	3.4		14.8	0.00339	4.4	0.9	421	120	0.37
Below Devil's Cr	7041.79	10-year	2870	7.6	16.1	4.5		16.6	0.003267	5.3	1.2	625	132	0.38
Below Devil's Cr	7041.79	100-year	4480	7.6	17.9	3.6		18.4	0.003316	6.3	1.6	880	235	0.4
Below Devil's Cr	6924.16	2-year	1700	7.4	14.3	4.6		14.5	0.001947	3.8	0.6	448	95	0.3
Below Devil's Cr	6924.16	10-year	2870	7.4	15.9	5.8		16.2	0.002172	4.9	0.9	602	99	0.34
Below Devil's Cr	6924.16	100-year	4480	7.4	17.5	6.9		18.1	0.002447	6	1.2	774	106	0.37
Below Devil's Cr	6703.48	2-year	1700	8	13.4	3.7		13.9	0.003636	5.7	0.9	305	82	0.49
Below Devil's Cr	6703.48	10-year	2870	8	14.8	4.2		15.6	0.003908	7.1	1.3	425	98	0.54

Project: Buskin River														
Plan: Buskin Existing MHHW			Steady Flow: Buskin MHHW											
			Run as Subcritical											
Geometry: Existing Conditions												4/1/2008		
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Hydr Radius (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Below Devil's Cr	6703.48	100-year	4480	8	16.3	3.6	17.4	0.004043	8.5	1.7	653	178	0.57	
Below Devil's Cr	6511.82	2-year	1700	7.8	12.9	4		13.3	0.002455	4.8	0.6	354	85	0.41
Below Devil's Cr	6511.82	10-year	2870	7.8	14.3	5.1		14.9	0.002842	6.2	1	471	88	0.46
Below Devil's Cr	6511.82	100-year	4480	7.8	15.8	2.9		16.6	0.003074	7.5	1.3	726	245	0.5
Below Devil's Cr	6358.15	2-year	1700	7.5	12.6	4.2	10.3	12.9	0.002423	4.2	0.7	412	96	0.35
Below Devil's Cr	6358.15	10-year	2870	7.5	13.9	4.4	11.3	14.4	0.002919	5.4	1	554	148	0.4
Below Devil's Cr	6358.15	100-year	4480	7.5	15.5	3.4	12.4	16.1	0.003082	6.5	1.4	864	284	0.42
Below Devil's Cr	6254.87	2-year	1700	7	12.1	3.1	10.5	12.5	0.008348	4.5	1.7	379	117	0.43
Below Devil's Cr	6254.87	10-year	2870	7	13.5	4.1	11.5	13.9	0.007842	5.4	2.2	539	186	0.44
Below Devil's Cr	6254.87	100-year	4480	7	15.1	3.4	12.5	15.6	0.006101	5.9	2.3	959	368	0.41
Below Devil's Cr	6079.51	2-year	1700	7	11.9	3.1		12	0.001012	2.2	0.2	791	252	0.21
Below Devil's Cr	6079.51	10-year	2870	7	13.4	4.3		13.5	0.000939	2.6	0.3	1165	269	0.21
Below Devil's Cr	6079.51	100-year	4480	7	15.1	5.8		15.2	0.000843	2.9	0.3	1632	276	0.2
Below Devil's Cr	5858.48	2-year	1700	7	11.6	2.9	9.4	11.7	0.002455	1.7	0.5	994	338	0.18
Below Devil's Cr	5858.48	10-year	2870	7	13.1	4.3	10	13.2	0.001788	1.9	0.5	1501	343	0.16
Below Devil's Cr	5858.48	100-year	4480	7	14.9	5.9	10.4	14.9	0.001418	2.1	0.5	2113	350	0.15
Below Devil's Cr	5768	2-year	1700	5.2	11.6	4.6		11.6	0.000173	1.3	0.1	1332	284	0.1
Below Devil's Cr	5768	10-year	2870	5.2	13.1	6		13.1	0.000207	1.7	0.1	1757	288	0.12
Below Devil's Cr	5768	100-year	4480	5.2	14.8	7.6		14.9	0.000226	2	0.1	2268	292	0.12
Below Devil's Cr	5681.59	2-year	1700	5.2	11.5	4.3		11.6	0.001362	2.4	0.4	720	161	0.2
Below Devil's Cr	5681.59	10-year	2870	5.2	12.9	5.5		13.1	0.00156	3	0.6	955	168	0.22
Below Devil's Cr	5681.59	100-year	4480	5.2	14.6	6.7		14.8	0.001639	3.7	0.8	1253	181	0.23
Below Devil's Cr	5471.28	2-year	1700	4.6	11.1	4.8		11.3	0.001016	3.8	0.4	500	102	0.28
Below Devil's Cr	5471.28	10-year	2870	4.6	12.3	5.5		12.7	0.001517	5.3	0.7	628	112	0.35
Below Devil's Cr	5471.28	100-year	4480	4.6	13.7	6.4		14.4	0.001928	6.7	1	797	122	0.41
Below Devil's Cr	5324.83	2-year	1700	2.1	11.1	3.3		11.2	0.000424	2.3	0.1	952	288	0.18
Below Devil's Cr	5324.83	10-year	2870	2.1	12.4	3.8		12.5	0.000524	3	0.2	1363	349	0.2
Below Devil's Cr	5324.83	100-year	4480	2.1	14	4.8		14.1	0.000528	3.5	0.3	1980	406	0.21
Below Devil's Cr	5234.21	2-year	1700	4.3	11.1	3.3		11.1	0.000389	2.2	0.1	1082	325	0.17
Below Devil's Cr	5234.21	10-year	2870	4.3	12.4	3.9		12.5	0.000485	2.9	0.2	1536	397	0.2
Below Devil's Cr	5234.21	100-year	4480	4.3	13.9	4.7		14.1	0.000502	3.4	0.3	2231	470	0.21
Below Devil's Cr	5003.97	2-year	1700	2.8	10.9	4.3		11	0.002177	2.7	0.7	634	143	0.22

Project: Buskin River		Steady Flow: Buskin MHHW												
Plan: Buskin Existing MHHW		Run as Subcritical												
Geometry: Existing Conditions		4/1/2008												
HEC-RAS Plan: Exist MHHW		River: Buskin Reach: Below Devil's Cr												
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El	W.S. Elev	Hydr Radius	Crit W.S.	E.G. Elev	E.G. Slope (ft/ft)	Vel Chnl	Shear Chan (lb/sq ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Below Devil's Cr	5003.97	10-year	2870	2.8	12	5		12.2	0.002994	3.7	1.1	809	157	0.26
Below Devil's Cr	5003.97	100-year	4480	2.8	13.5	5.7		13.8	0.00339	4.6	1.6	1065	185	0.29
Below Devil's Cr	4779.81	2-year	1700	4.7	10.3	3.5		10.4	0.003064	2.5	0.7	687	192	0.23
Below Devil's Cr	4779.81	10-year	2870	4.7	11.3	4.4		11.5	0.003916	3.3	1.1	881	198	0.27
Below Devil's Cr	4779.81	100-year	4480	4.7	12.8	5.6		13	0.003743	3.9	1.4	1185	207	0.27
Below Devil's Cr	4655.57	2-year	1700	2.6	10	4.1		10.2	0.001073	3.1	0.3	559	133	0.26
Below Devil's Cr	4655.57	10-year	2870	2.6	10.8	4.8		11.1	0.001959	4.4	0.6	665	137	0.34
Below Devil's Cr	4655.57	100-year	4480	2.6	12.2	5.8		12.6	0.002456	5.4	1	856	144	0.37
Below Devil's Cr	4495.71	2-year	1700	1.1	9.7	5.4		10	0.001247	4	0.4	422	75	0.3
Below Devil's Cr	4495.71	10-year	2870	1.1	10	5.5		10.6	0.003122	6.5	1.1	441	76	0.48
Below Devil's Cr	4495.71	100-year	4480	1.1	10.3	5.8		11.7	0.006358	9.6	2.3	469	77	0.68
Below Devil's Cr	4415.33	2-year	1700	2.8	9.8	3.7	7	9.8	0.000344	1.8	0.1	947	324	0.16
Below Devil's Cr	4415.33	10-year	2870	2.8	10.1	3.8	7.5	10.2	0.000739	2.8	0.2	1041	350	0.24
Below Devil's Cr	4415.33	100-year	4480	2.8	10.7	3.1	8.1	10.9	0.001095	3.7	0.3	1252	519	0.3
Below Devil's Cr	4187.74	2-year	1700	3.3	9.7	2.9	6.2	9.7	0.000185	1.4	0	1251	437	0.14
Below Devil's Cr	4187.74	10-year	2870	3.3	10	3	7	10.1	0.000399	2.1	0.1	1394	501	0.2
Below Devil's Cr	4187.74	100-year	4480	3.3	10.6	2.6	8.1	10.7	0.000581	2.7	0.1	1763	684	0.24
Below Devil's Cr	4050.14	2-year	1700	2.8	9.7	3.2	6.3	9.7	0.000135	1.1	0	1494	615	0.11
Below Devil's Cr	4050.14	10-year	2870	2.8	10	3	7.3	10	0.000286	1.7	0.1	1727	665	0.16
Below Devil's Cr	4050.14	100-year	4480	2.8	10.6	3	7.8	10.7	0.00041	2.2	0.1	2181	724	0.19
Below Devil's Cr	3923.07	2-year	1700	1.7	9.7	3.2	5.1	9.7	0.000036	0.7	0	2391	751	0.07
Below Devil's Cr	3923.07	10-year	2870	1.7	10	3.4	5.6	10	0.000083	1.1	0	2617	761	0.1
Below Devil's Cr	3923.07	100-year	4480	1.7	10.6	3.8	6.2	10.6	0.000134	1.5	0	3072	797	0.12
Below Devil's Cr	3754.68	2-year	1700	3.7	9.7	4.1	5	9.7	0.00001	0.4	0	4177	1098	0.04
Below Devil's Cr	3754.68	10-year	2870	3.7	10	4.4	5.3	10	0.000024	0.6	0	4482	1102	0.05
Below Devil's Cr	3754.68	100-year	4480	3.7	10.6	5	5.6	10.6	0.00004	0.9	0	5088	1108	0.07
Below Devil's Cr	3695.3	2-year	1700	0.6	9.7	3.6	5.2	9.7	0.000024	0.6	0	2989	1039	0.05
Below Devil's Cr	3695.3	10-year	2870	0.6	10	3.9	5.7	10	0.000055	0.9	0	3233	1052	0.08
Below Devil's Cr	3695.3	100-year	4480	0.6	10.6	4.3	6.1	10.6	0.000089	1.3	0	3728	1083	0.1
Below Devil's Cr	3567.52	2-year	1700	2.8	9.7	3.5	5.7	9.7	0.000037	0.8	0	2376	939	0.07
Below Devil's Cr	3567.52	10-year	2870	2.8	10	3.7	6.1	10	0.000085	1.2	0	2570	951	0.1
Below Devil's Cr	3567.52	100-year	4480	2.8	10.5	4.2	6.5	10.6	0.000138	1.6	0	2973	979	0.13

Project: Buskin River														
Steady Flow: Buskin MHHW														
Plan: Buskin Existing MHHW Run as Subcritical														
Geometry: Existing Conditions 4/1/2008														
HEC-RAS Plan: Exist MHHW River: Buskin Reach: Below Devil's Cr														
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El	W.S. Elev	Hydr Radius	Crit W.S.	E.G. Elev	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Below Devil's Cr	3383.39	2-year	1700	2.6	9.7	4.1	5.3	9.7	0.000083	1.2	0	1450	859	0.1
Below Devil's Cr	3383.39	10-year	2870	2.6	9.9	4.3	5.9	10	0.000199	1.9	0.1	1538	866	0.16
Below Devil's Cr	3383.39	100-year	4480	2.6	10.5	3.8	6.5	10.6	0.00026	2	0.1	2269	892	0.18
Below Devil's Cr	3162.69	2-year	1700	-0.5	9.6	3.4	3.8	9.7	0.000075	1.2	0	1412	766	0.11
Below Devil's Cr	3162.69	10-year	2870	-0.5	9.9	3.6	4.9	9.9	0.000185	1.9	0	1503	770	0.18
Below Devil's Cr	3162.69	100-year	4480	-0.5	10.4	4.1	5.7	10.5	0.000333	2.6	0.1	1713	779	0.23
Below Devil's Cr	3057.93	2-year	1700	0.6	9.6	3.4	3.9	9.7	0.000203	1.9	0	894	601	0.18
Below Devil's Cr	3057.93	10-year	2870	0.6	9.7	3.6	5.1	9.9	0.000531	3.1	0.1	930	604	0.29
Below Devil's Cr	3057.93	100-year	4480	0.6	10.1	3.9	6.4	10.4	0.001034	4.4	0.3	1027	611	0.39
Below Devil's Cr	2853.12	2-year	1700	1.5	9.5	5.2	4.7	9.6	0.000261	2.3	0.1	753	557	0.17
Below Devil's Cr	2853.12	10-year	2870	1.5	9.5	5.2	5.7	9.8	0.000743	3.8	0.2	753	557	0.29
Below Devil's Cr	2853.12	100-year	4480	1.5	9.6	5.2	6.8	10.1	0.001773	5.9	0.6	760	557	0.45
Below Devil's Cr	2680.35	2-year	1700	0.9	9.5	5.6	4.2	9.6	0.000246	2.3	0.1	738	638	0.17
Below Devil's Cr	2680.35	10-year	2870	0.9	9.4	5.6	5.3	9.6	0.000734	4	0.3	725	635	0.29
Below Devil's Cr	2680.35	100-year	4480	0.9	9.1	5.4	6.5	9.8	0.002026	6.5	0.7	693	628	0.49
Below Devil's Cr	2555.61	2-year	1700	-0.3	9.5	6		9.5	0.000005	0.3	0	4382	717	0.02
Below Devil's Cr	2555.61	10-year	2870	-0.3	9.5	6		9.5	0.000013	0.6	0	4387	717	0.04
Below Devil's Cr	2555.61	100-year	4480	-0.3	9.6	6		9.6	0.000032	0.9	0	4396	717	0.06
Below Devil's Cr	2432.76	2-year	1700	1.1	9.5	6		9.5	0.000004	0.3	0	4717	771	0.02
Below Devil's Cr	2432.76	10-year	2870	1.1	9.5	6		9.5	0.000012	0.5	0	4721	771	0.04
Below Devil's Cr	2432.76	100-year	4480	1.1	9.5	6.1		9.6	0.000028	0.8	0	4730	771	0.06
Below Devil's Cr	2314	2-year	1700	1.4	9.5	5.4		9.5	0.000007	0.4	0	3972	722	0.03
Below Devil's Cr	2314	10-year	2870	1.4	9.5	5.4		9.5	0.00002	0.7	0	3973	722	0.05
Below Devil's Cr	2314	100-year	4480	1.4	9.5	5.4		9.6	0.000048	1	0	3976	722	0.08
Below Devil's Cr	2203.73	2-year	1700	1.5	9.5	5.5	3.1	9.5	0.000009	0.5	0	3563	651	0.03
Below Devil's Cr	2203.73	10-year	2870	1.5	9.5	5.5	3.6	9.5	0.000025	0.8	0	3562	651	0.06
Below Devil's Cr	2203.73	100-year	4480	1.5	9.5	5.5	4.1	9.6	0.000061	1.2	0	3561	651	0.09
Below Devil's Cr	2099.58	2-year	1700	1.5	9.5	5.5		9.5	0.00001	0.5	0	3270	587	0.03
Below Devil's Cr	2099.58	10-year	2870	1.5	9.5	5.5		9.5	0.000028	0.8	0	3267	587	0.06
Below Devil's Cr	2099.58	100-year	4480	1.5	9.5	5.5		9.5	0.000069	1.3	0	3261	587	0.09
Below Devil's Cr	2000	2-year	1700	0.8	9.5	5.8		9.5	0.000009	0.5	0	3336	567	0.03
Below Devil's Cr	2000	10-year	2870	0.8	9.5	5.8		9.5	0.000026	0.8	0	3333	567	0.06
Below Devil's Cr	2000	100-year	4480	0.8	9.5	5.8		9.5	0.000064	1.2	0	3327	567	0.09

**Project: Buskin River**                    **Steady Flow: Buskin MHHW**  
**Plan: Buskin Existing MHHW**            **Run as Subcritical**  
**Geometry: Existing Conditions**            **4/1/2008**  
**HEC-RAS Plan: Exist MHHW**    **River: Buskin**    **Reach: Below Devil's Cr**

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Hydr Radius (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Below Devil's Cr	1350	2-year	1700	0	9.5	9.5	0.1	9.5	0	0	0	95300	10001	0
Below Devil's Cr	1350	10-year	2870	0	9.5	9.5	0.1	9.5	0	0	0	95300	10001	0
Below Devil's Cr	1350	100-year	4480	0	9.5	9.5	0.2	9.5	0	0	0	95300	10001	0